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ANNUAL AIR TRANSPORT PROGRESS ISSUE

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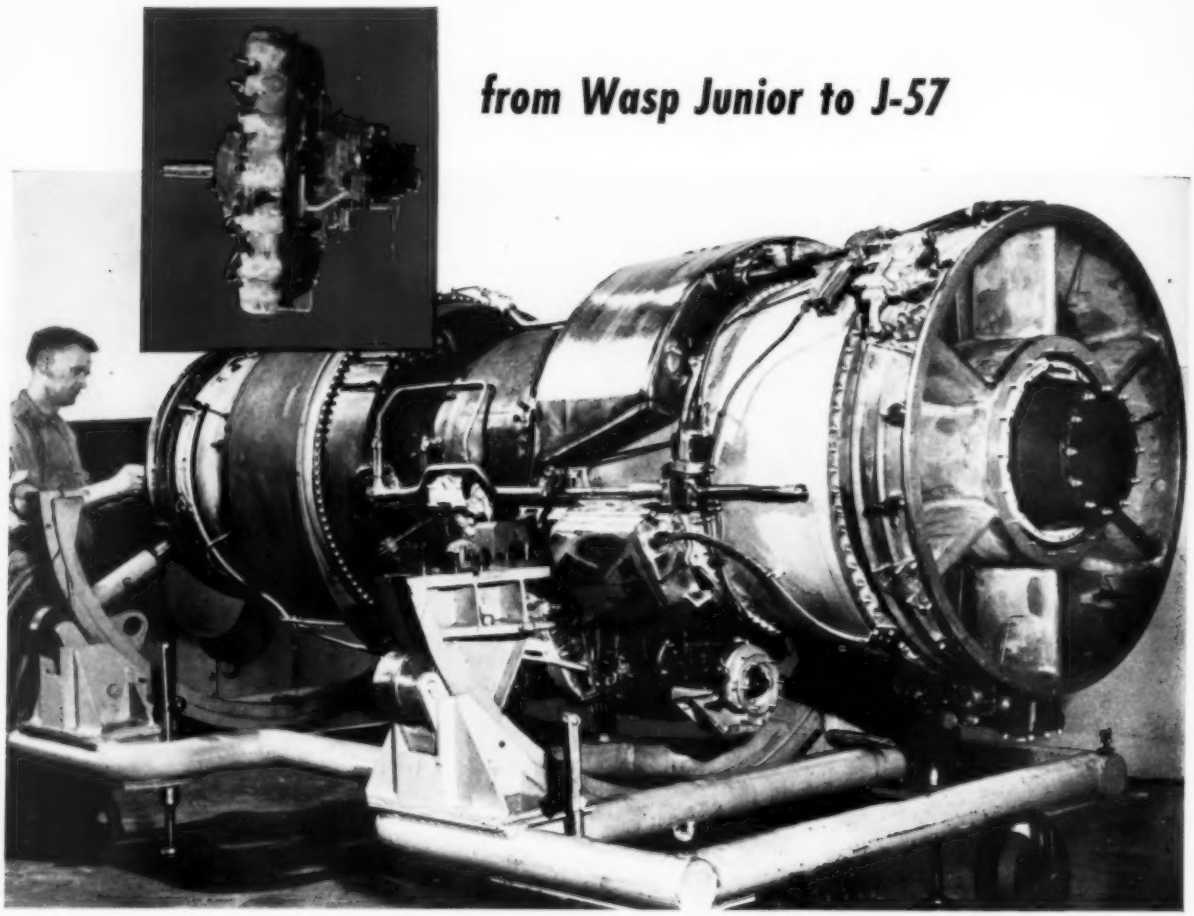

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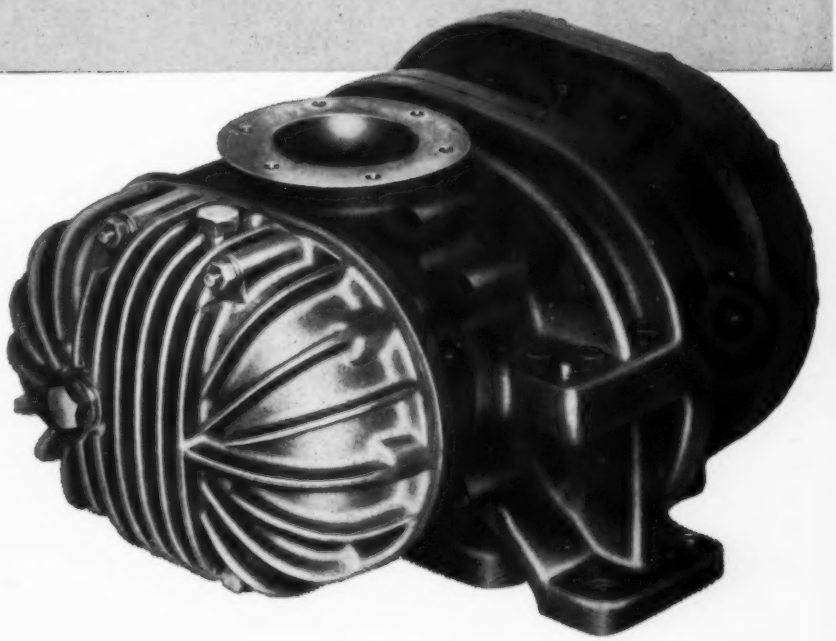

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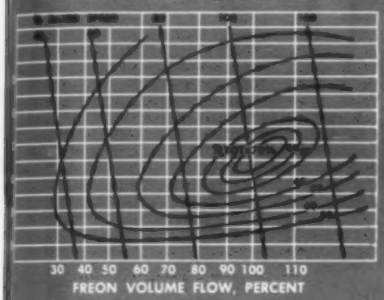
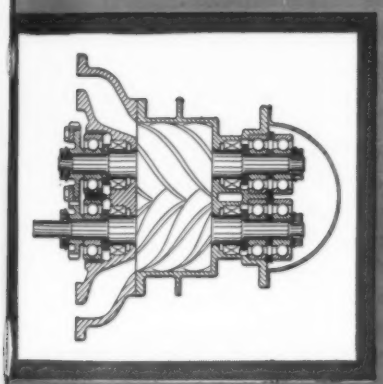
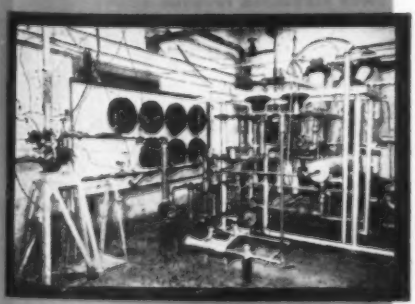


Performance Map Shows Compressor's Efficiency



Cutaway View Showing Compression Principle



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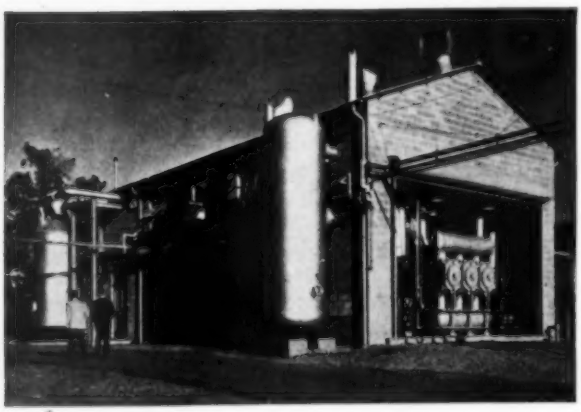

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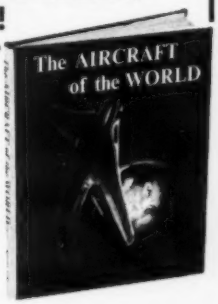

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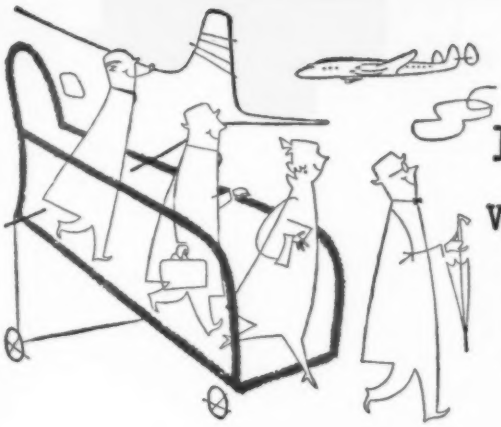

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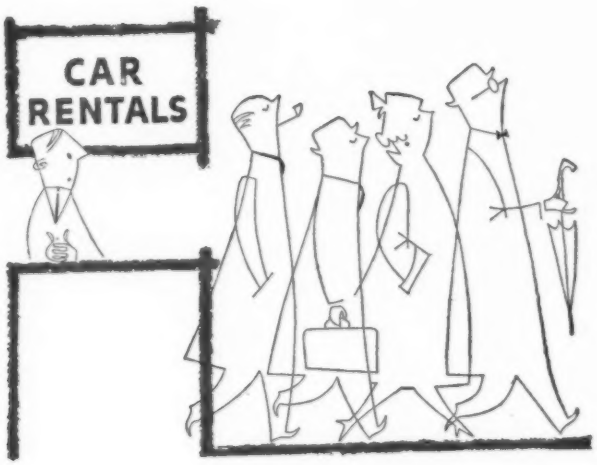

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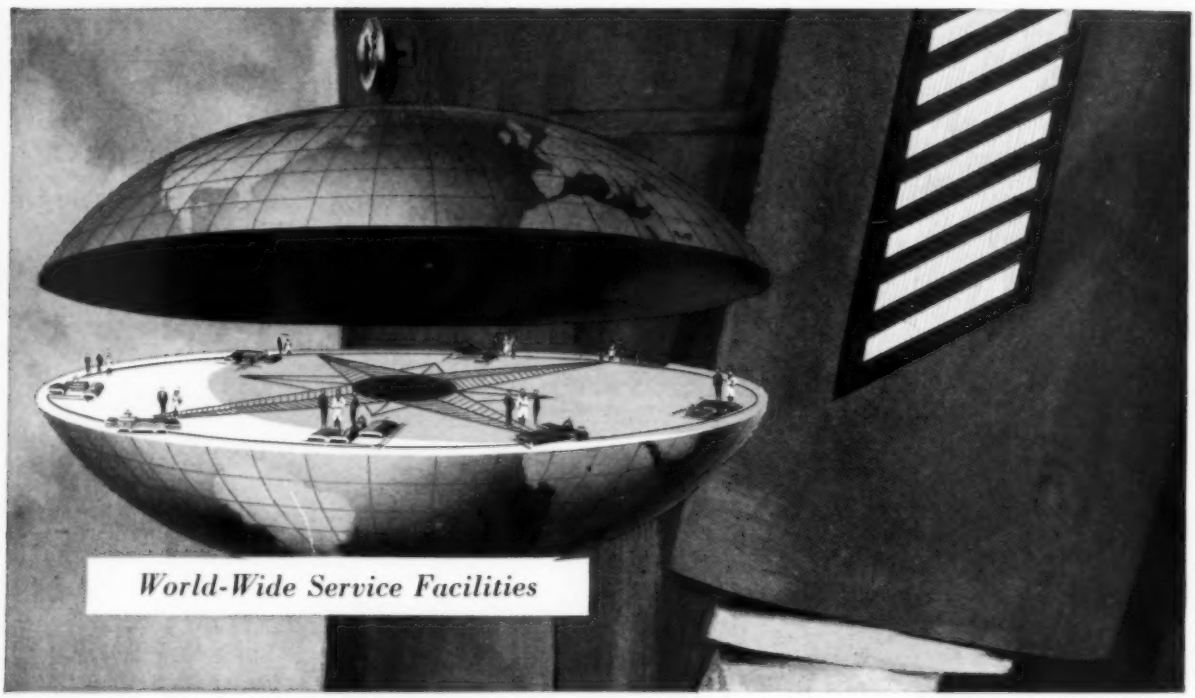

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Personal View

By WAYNE W. PARRISH

The Airplane Leads a Merry Chase

IT IS SCARCELY sensational news that the airlines of the world have turned in another record-breaking year all around the globe. The upward trend is taken for granted.

Yet there is drama in these gains. Real drama. Reflect for the moment and you can sense it. The dreams and sweat of the pioneers have created a truly great industry.

Last year was only the tenth year of commercial transatlantic air service, yet over 652,000 passengers flew between the continents in the medium of air. That's a lot of passengers—18.58% more than the preceding year. How such a figure would have been scoffed at a generation ago if anyone had been so foolhardy as to predict it!

In the U.S.A. the record is at least as impressive. Over 38 million passengers were carried by scheduled carriers last year. American Airlines alone carried over seven million.

These are astonishing figures for an industry not yet thirty years old.

The direction is up. It will be up for a long time.

But the problems of air transport are multiplying, not decreasing. They are nothing short of staggering.

First and foremost is air traffic control. In the U.S., particularly, this has become critical. Saturation has been reached in many areas. President Eisenhower has appointed able Edward P. Curtis to tackle the enormous job of laying out a program to meld commercial, civil and military airways control into a system suitable and adequate for the future. It's a tough project. But it must be solved soon before commercial jets go into service and before major tragedy occurs on the airways.

The technical performance of the airplane has out-paced every other element in the field of air transport. It has placed a stress and strain on company organizations. It has outrun ground handling facilities. It has run far ahead of governmental regulatory brains. And it has out-flown almost everything else except the public's desire to patronize it in increasing numbers.

If there is any single astonishing feature of air transport today it is that the whole thing performs as well as it does.

The growth record has taxed every airline organization. Many have failed to train sufficient junior executives to move into key positions. Some companies have attempted to expand exclusively from within but the ingrowing technique has long since been abandoned by progressive industrial concerns as being wholly inadequate for mature growth. Many changes in executive personnel are in store for the next decade as more and more pioneers retire. Too few organizations are competently staffed for the stresses and strains to come.

Governmentally, the record of industry growth has out-run the regulatory brains. In a large sense it can be said that industry has progressed in spite of and not because of sound government regulation. In the final analysis it has been the public and competition that have been the prime regulators of the air carriers. But outside the U.S. the public has not been in a position to be such a dominant force in seeking and obtaining improved service.

Where air transport is running into its heaviest weather is in the international government area where national interests and jealousies and local protectionists place ramp blocks in the way of expanded services. The sky is open but the ground rights are not. Those who had hoped for genuine freedom of the air have become disillusioned as more and more national interests restrict freedom of service and schedules. The problem of traffic rights has become more confused and frustrating each year.

Ground handling continues to be a major problem for all carriers. While airport-to-airport time has been reduced steadily, there have been too few improvements on the ground. Whether wisely or not, carriers generally have avoided responsibility for passenger-handling except on an airport-to-airport basis. As the flying part of the journey has become more comfortable and faster, the ground segment has become more troublesome and lengthy. It is a major problem to which the airlines have attached insufficient importance.

Air freight continues to make some gains but red tape plagues the international field. It usually takes more time for a cargo item to move from airport to city center than for the air journey no matter how long the latter may be.

Airlines have become more businesslike in their approach to the public but many of these gains have gone unnoticed because of the constant expansion of traffic volume. The most irksome feature of air transport —reservations—is also the most baffling. The no-show problem is a very large one and remains to be solved. Top managements have been so engrossed in the magnitude of the equipment, financing and organizational problems that insufficient time and attention has been given by top personnel to such vital matters as no-shows.

Sales-wise there are many areas for future expansion which will doubtless get more attention when and if available equipment catches up with demand. One large area for attention is the attraction of European traffic to North America. Emphasis to date has been on carriage of Americans to Europe, but little attention has been given to flying Europeans to America. The airlines will have to put pressure on the U.S. government to ease formalities for visitors and they will also have to develop cheap package tours. There is a fine potential market here awaiting development.

In this seventh annual air transport issue of AMERICAN AVIATION will be found a bountiful supply of statistics and information relating to industry progress, both in the U.S. and abroad. It is a record of enormous achievement. It is also a vigorous indication of challenging problems ahead.

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Production Spotlight

• With two of its Douglas R6D (DC-6A) aircraft and two R5D (DC-4) already out on lease to commercial carriers, Navy is making plans to lease out 25 R4Ds (DC-3s).

• Project Capsule, being monitored by the Navy, calls for the development of a simplified pilot escape installation which will enable him to get out of an aircraft at supersonic speed without danger. Most of the expensive electronic equipment in the plane will be contained in the capsule and therefore reusable.

• Two new helicopter projects will be started by Navy next year, and development will continue on the large cargo unloader helicopter for the Marines. Initial orders also will be placed for three new plane types, including one whose powerplant won't be ready until January 1958.

• Bristol BE 41 turboprop may be installed in the production version of the Bristol 191 twin-engine helicopter. It is a 2,000-hp unit specially designed for rotorcraft application.

• First move has been made in a program for the Krupps-controlled Weser Aircraft Company to produce components for Republic F-84Fs and RF-84Fs to be supplied to German Air Force. The Bremen firm has been given a contract by Republic for providing technical assistance, facilities, equipment and personnel to the GAF in connection with the F-84F program.

• Although a long-range version of Navy's Talos surface-to-air missile, the Talos-L, is slated for the USAF, Navy officials are worried about the lack of facilities money to take care of AF needs.

• About $27.9 million, or 12%, of the total Navy request for money to overhaul aircraft and engines in 1957, is scheduled to be farmed out commercially. For the past two years, the figure was about $15.9 million, or 8%.

• Avro Aircraft's CF-105 supersonic fighter now under construction may well be the last piloted warplane to be produced in Canada. Subsequent products of the Canadian aircraft industry will be missiles.

• Breguet Deux Ponts has been ordered back into production as a result of a French military contract for 15 of the 765 militarized version. Plane will be used to equip two heavy transport squadrons of the French Air Force.

• Latest and last of the ballistic missiles to be named is the Army-Navy IRBM, which has been labeled Jupiter. Ship-based Jupiter will be handled by a new Special Projects Office in the Bureau of Ordnance under Rear Adm. William F. Raborn. Fifteen million dollars in R&D money is allocated to the Navy Jupiter next year.

• A postwar high in the number of basic aircraft models was reached by Navy in 1955, when 70 types were in service vs. 72 in 1946. In 1949 the number was 51. This year Navy hopes to get down to 67, with 64 scheduled for 1957 and 63 for the following year.

• French government is speeding up production of SNCA du Sud-Est's big single-rotor turbine-powered transport helicopter. This model is now designated SE 3200; it previously was known as the SE 316.

• Production of the Dassault Mystere is well advanced—50 of the Mystere IIs on order have been delivered. The French company has built 129 of the 325 Mystere IVAs. Deliveries of 370 Mystere IVB2s will start in 1957.

• Goodyear Aircraft will produce the guidance system for the advanced Martin Matador missile. Goodyear also supplies the Matador ground support system.

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1-minute Flare
Efficient, safe, over 75,000 candlepower. For planes under 3500 lbs. gross weight. Three flares makes compact installation for private planes. Similar type flares can be fired from cabin with International flare pistols.
3-minute Flare
For planes of any weight, scheduled or unscheduled operations. Sealed all-metal case assures longer effective service life. May be installed in wings or fuselage. Exceeds 200,000 candlepower.
KILGORE, INC.
International Flare Signal Div.
Dept. 25
WESTERVILLE, OHIO
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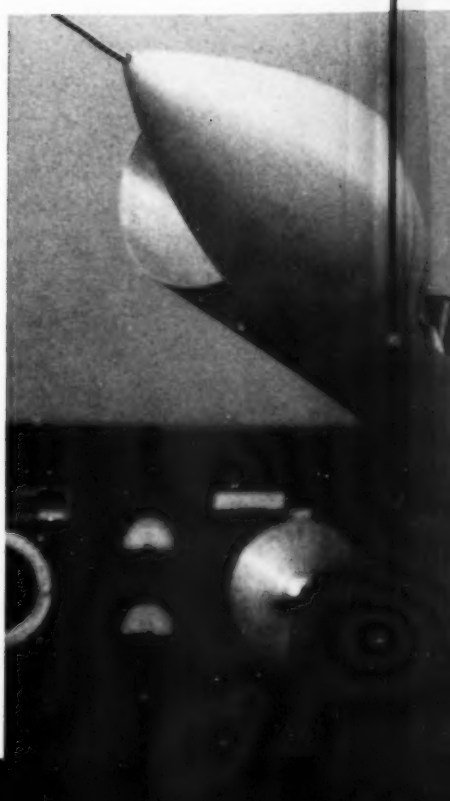
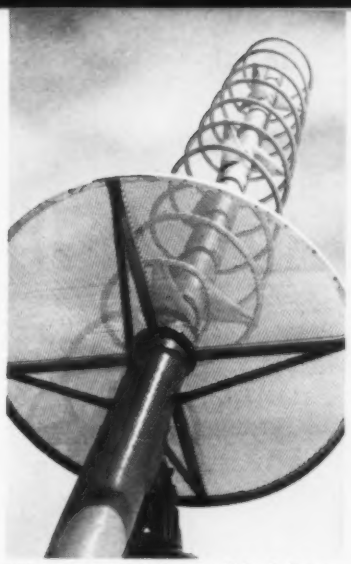
Lockheed Scientists– a new type of bird-man

Pioneer bird-men risked their lives to prove that man could fly. Today's bird-men are the scientists who dedicate their lives to research in the field of missiles (fantastic new "birds" which challenge the imagination) and to the development of the complex missile systems, so important to our defense efforts. Their work is secret, exciting and second to none in military importance—because America's supremacy in aerial weapons faces a menacing challenge.

Lockheed is helping the U.S. armed forces meet that challenge by the rapid expansion of its Missile Systems Division. At Van Nuys, California, a staff of over 3,000 workers is already deeply engaged in top-secret projects for the Air Force. Two new missile research laboratory buildings are being constructed by Lockheed on a 22-acre site in Stanford University's industrial park area at Palo Alto, California. And nearby, on a 275-acre site at Sunnyvale, Lockheed is building extensive engineering and manufacturing facilities.

Everyone at Lockheed's Missile Systems Division is working with a sense of deep urgency to help the nation retain its superiority in missile systems technology—and thus deter attack from any potential aggressor.





A VITAL PHASE of successful missile systems research and development is the testing of vehicles and components under actual operating conditions. This helical antenna (above) receives telemetered data transmitted from test missiles.

(ABOVE) SCIENTISTS at Missile Systems Division using cold-flow test chamber to obtain data on flow rate of liquid fuels at the extreme temperatures which might be encountered by a supersonic, high-altitude missile in flight.

(AT LEFT) DR. LOUIS N. RIDENOUR, first Chief Scientist of the U.S. Air Force (1950-51), now Research Director of Lockheed Missile Systems Division, shown with a senior scientist and a student-scientist* discussing simulated trajectory of a high-altitude ballistic missile. Lockheed's advanced research programs include: conditions bearing on flight into space, chemical propulsion systems, power applications of nuclear energy, physical studies of environments created by radioactivity, advanced studies of applications of electronic phenomena, new principles in the remote guidance field, and others.

(BELOW) A DEMONSTRATION MODEL, used to illustrate the fundamentals of telemetering systems. Many advanced contributions in this field, as well as in the fields of guidance control and data reduction, have been made by Lockheed's Missile Systems Division.

(ABOVE) The speed-up construction program now under way at Palo Alto will permit use of Lockheed's new research laboratories by the start of the fall semester at Stanford University.

**Lockheed's Advanced Study Program helps outstanding students, while employed, achieve MS degrees in Mathematics, Electrical and Mechanical Engineering, Aeronautics and other Physical Sciences. Write: Lockheed Missile Systems Division, Van Nuys, California.*

Lockheed

MISSILE SYSTEMS DIVISION

Van Nuys, Palo Alto, Sunnyvale, Calif.

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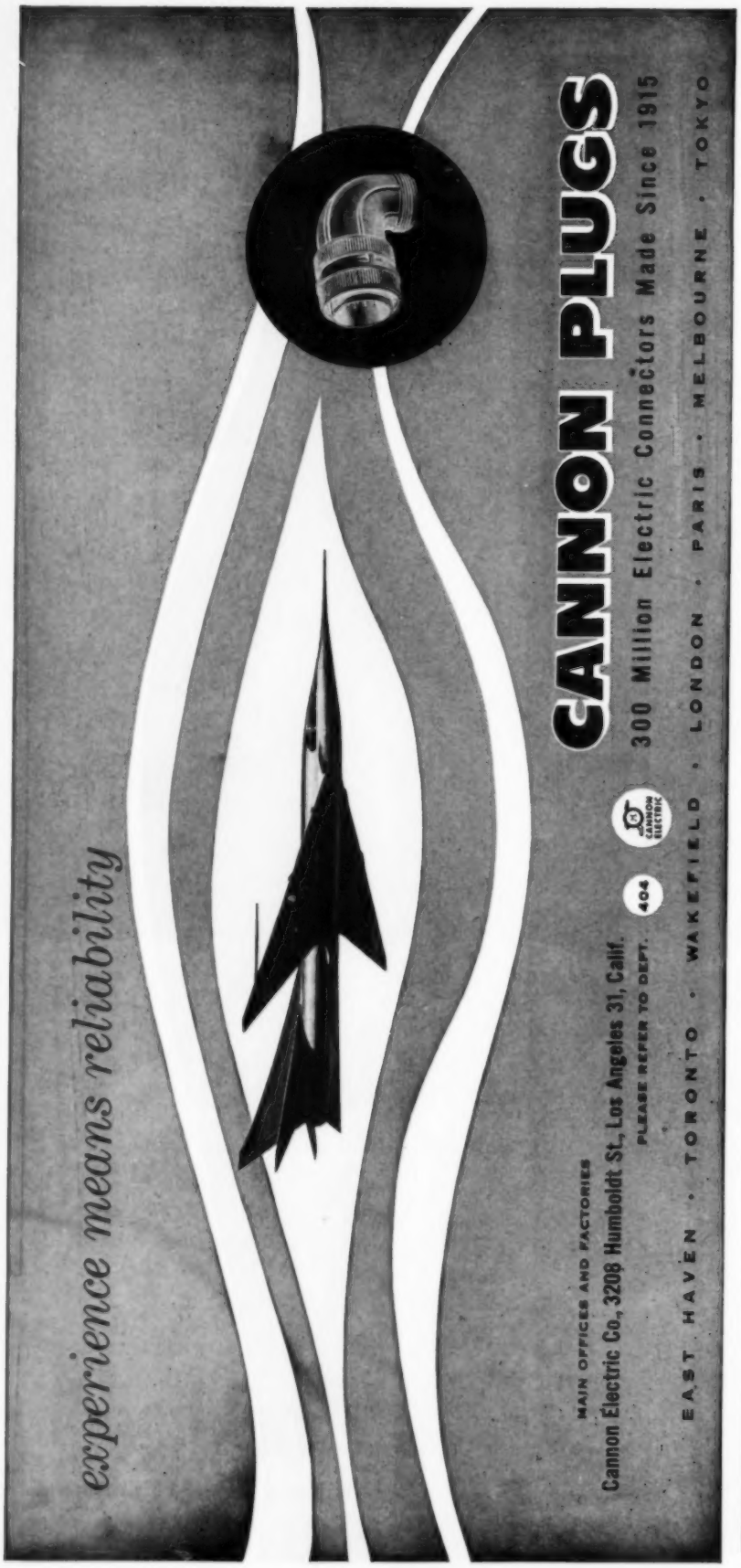
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When & Where

APRIL

Apr. 22-26—Twenty-ninth convention American Association of Airport Executives, Hotel Carter, Cleveland.

Apr. 23-24—New England Radio Engineering Meeting, Sheraton Plaza Hotel, Boston.

Apr. 26-27—Annual meeting Aeronautical Training Society, Mayflower Hotel, Washington, D. C.

April 30-May 4—Fifteenth National Conference, Society of Aeronautical Weight Engineers, El Cortez Hotel, San Diego, Calif.

MAY

May 1-3—Electronic Components Symposium sponsored by IRE, ALEE, RETMA, WCEMA, NBS, Departments of Defense and Commerce, Department of Interior Auditorium, Washington, D. C.

May 2—Fourteenth annual conference Society of Aeronautical Weight Engineers, Ft. Worth.

May 2-3—Southwest Jet Age Conference, Cimarron Ballroom and Mayo Hotel, Tulsa, Okla.

May 2-3—Air Traffic Conference, spring meeting, Hotel Radisson, Minneapolis.

May 2-5—American Helicopter Society, 12th Annual National Forum, Sheraton-Park Hotel, Washington, D. C.

May 3-4—Sixth annual IAS West Coast Student Conference, Los Angeles.

May 6-9—Second National Flight Test Instrumentation Symposium, Instrument Society of America, Hotel Texas, Ft. Worth, Tex.

May 14-15—National Aeronautical and Navigational Conference, Hotel Biltmore, Dayton, Ohio.

May 20—Annual Air Show sponsored by Birmingham Aero Club, Birmingham NAS, Ala.

May 24-26—Tenth annual convention of Armed Forces Communications and Electronics Association, Statler Hotel, Boston.

May 27-June 3—Annual Convention, Aviation Writers Association, San Francisco.

JUNE

June 2—Seventh annual maintenance and operations meeting, Reading Aviation Service, Inc., Municipal Airport, Reading, Pa.

June 3-8—Summer meeting Society of Automotive Engineers, Hotel Chalfonte, Atlantic City.

June 4-8—National Fire Protection Association, 60th annual meeting, Boston.

June 6-8—American Society for Quality Control, Palais Du Commerce, Montreal, Canada.

June 13—B. F. Goodrich Technical Forum sponsored by Atlantic Aviation Corp. and Airwork Corp., Teterboro Airport, N. J.

June 17-21—Semiannual meeting American Society of Mechanical Engineers, Hotel Statler, Cleveland.

June 18-21—National summer meeting of Institute of Aeronautical Sciences, IAS Building, Los Angeles.

June 19—Tenth session of International Civil Aviation Organization Assembly, Caracas, Venezuela.

June 20-22—Aviation Distributors and Manufacturers Association 27th annual meeting, Grove Park Inn, Asheville, N. C.

JULY

July 7-10—Tenth annual All-Woman Transcontinental Air Race, San Mateo County (Calif.) to Flint, Mich.

July 10-Aug. 9—International Aviation Exposition, Mexico City.

AUGUST

Aug. 1-5—Air Force Association annual convention, Roosevelt Hotel and Municipal Auditorium, New Orleans.

Aug. 15-17—IAS National Turbine-powered Air Transportation Meeting, Grant Hotel, San Diego, Calif.

Aug. 21-24—Western Electronics Show and Convention, sponsored by IRE and West Coast Electronic Mfrs. Assn., Pan-Pacific Auditorium, Los Angeles.

Aug. 22-24—Bendix Scintilla Int'l Ignition Conference, Sidney, N. Y.

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Letters

Praise for Editorial

To the Editor:

Thank God for your page called "Personal View" in the April 9 edition, in which you take Americans to task for their naivete regarding our status relative to that of Soviet Russia. You really hit the nail on the head, and I hope this editorial will go a long way towards calming people down.

I am taking the liberty of tearing this page and sending it to Harlow Curtice.

H. B. MILLER

New York City

To the Editor:

Congratulations for your article "Personal View" appearing in the April 9, 1956 issue of AMERICAN AVIATION.

This makes sense, plenty of sense.

ALFRED S. KOCH

Falls Church, Virginia

To the Editor:

Thanks a million for your editorial in your April 9 number. It's wonderful. I only hope that it will be read and understood in enough places. I agree with every word in it.

A. F. BONNALIE
United Air Lines
Director of Training
Flight Operations

Denver 7, Colorado

Correction Noted

To the Editor:

Judging from the description in AMERICAN AVIATION, February 27, the Lycoming XT53 engine promises to be a remarkable powerplant in many respects. However, there is one thing it certainly is not—it isn't the first free turbine engine designed in the U.S. as your headline stated. That honor belongs to the Boeing 502 series power plants, also admirably suited to helicopter and aircraft use.

The Boeing 502 series in 1953 powered a light airplane, the Cessna XL-19B, to 37,063 feet—a world's altitude record for airplanes of its class. It also powered the Kaman HTK-1, first twin-turbine helicopter.

In addition, the versatile lightweight Boeing turbines have powered a highway truck, a racing car, landing craft, minesweeper boats, stationary pumps and generators, air compressors for starting large jet engines, testing airplane pneumatic systems, de-icing airplanes on the ground, and even railroad switching locomotives.

The company began engineering work on the Boeing gas turbine in 1943. The first shaft drive engine, the 502-1, was run in June, 1947. All engines produced since—and the 500th was turned out in January of this year—have been improved versions of the first 502.

The 502 is a split-shaft engine—that is, a free-turbine engine—with single-stage centrifugal compressor, two straight-through combustion chambers, and two single-stage axial turbines. Present engines, in production for the U.S. Navy and U.S. Air Force, are the Boeing 502-10 series which produce 270 hp maximum, 240 hp continuously. They are built in Seattle by the company's

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TO Zulu...

IT'S AC AIRCRAFT SPARK PLUGS

"From Alfa to Zulu it's Alfa Charlie!" . . . that's the International Civil Aeronautics Organization's newest code for "From A to Z it's AC." Under any and all operating conditions, you'll find AC Aircraft Spark Plugs best for the planes you fly!

For instance, each tip of the AC *three-prong electrode* flares out into a broad base. This feature helps conduct heat away from the electrode more rapidly to greatly reduce damaging erosion. In addition, it provides better scavenging action to reduce fouling, and offers easier, more effective cleaning when plugs are reconditioned.

Get AC Aircraft Spark Plugs with the *three-prong electrode* for the planes you fly!

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NORTH AMERICAN HAS BUILT MORE AIRPLANES

JET POWER

TODAY

The Navy's new FJ-4 FURY Jet Fighter is now undergoing its carrier trials. Newest in the FURY family of carrier-based jets, the FJ-4 climbs faster . . . maneuvers at higher altitudes, with longer range. This new and faster FURY is a product of North American's Columbus Division —a completely integrated aircraft engineering and production center where even faster, more potent aircraft are in continuing development. North American Aviation is a prime supplier of advanced aircraft to the Department of Defense.

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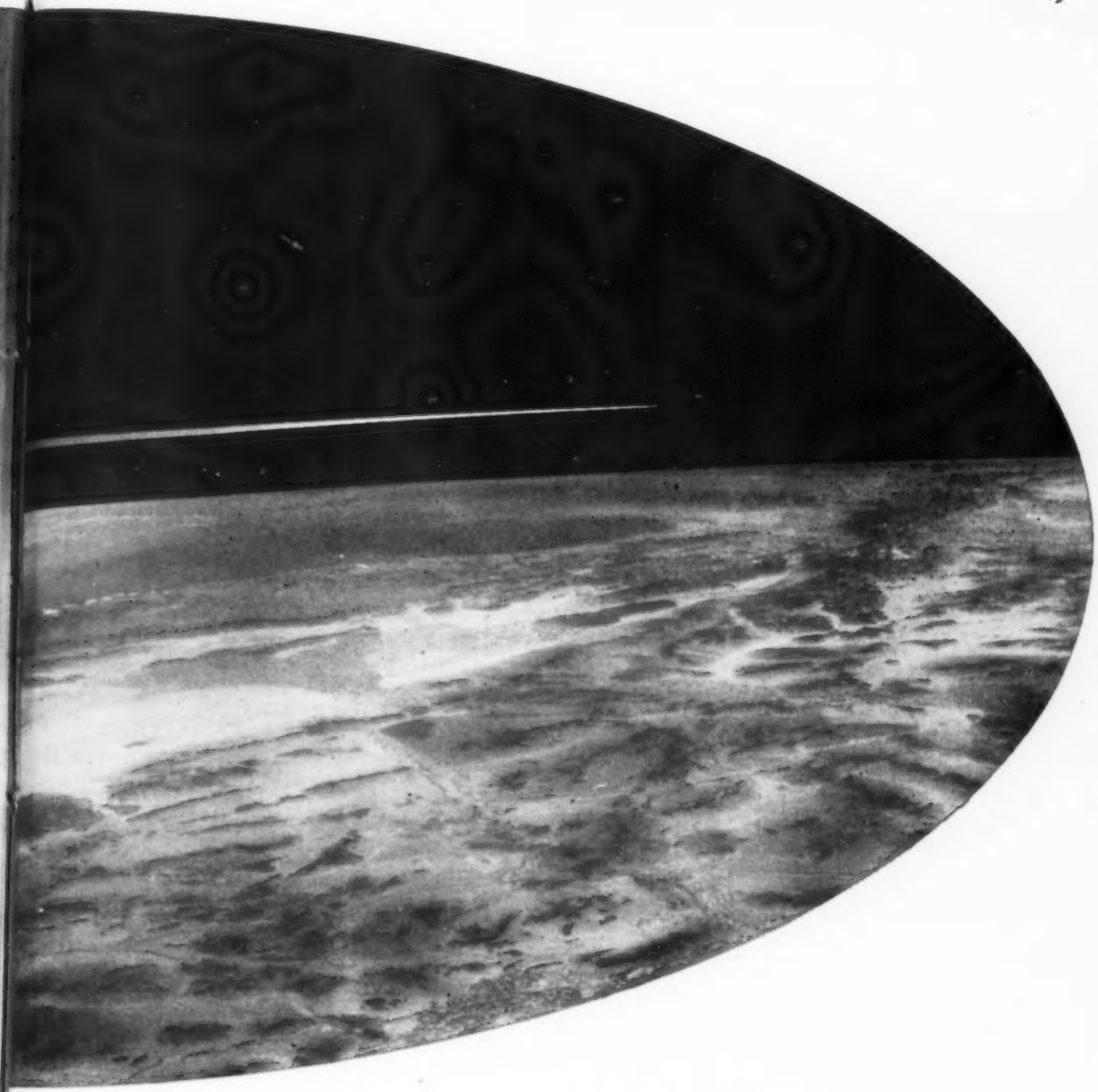
ES THAN ANY OTHER COMPANY IN THE WORLD



ARTIST'S CONCEPTION BASED ON OFFICIAL U. S. NAVY PHOTOGRAPH

SPACE POWER

TOMORROW

The SM-64 NAVAHO Intercontinental Guided Missile is a logical partner of our continuing development of supersonic, piloted aircraft. Security restrictions prohibit any details — but we can say that the NAVAHO will fly great distances at speeds far beyond supersonic. It will be guided and flown by automatic controls, driven by high-thrust rocket power. The NAVAHO extends the striking power and long-range defense of our nation farther than ever before.

North American Aviation, Inc., Los Angeles, Downey, Canoga Park, Fresno, Calif.; Columbus, O.

AMERICAN AVIATION, INC.

Engineers: write for details regarding challenging positions now open.

Filter Tests Show Important Savings

1,200-hour flight tests of Winslow filters on R-4360 engines by Pan American World Airways indicate savings of hundreds of dollars per engine, for replacement parts and labor.

During the tests, at 901:46 T.S.O., a piston failed in a filter-equipped engine. Because the Winslow CP* full-flow filter picked up the metal particles, cost of repairs was only $315.39 – the average cost for piston failure on eight other engines was $1,935 per engine.

Winslow has CAA-approved full-flow filters for most aircraft engines. For engineering data and recommendations for your equipment, please write: Aviation Department, Winslow Engineering Company, 4069 Hollis Street, Oakland 8, California.

CP* (Controlled Pressure) is fully protected by patents and trademarks.

AV-56-1

WINSLOW FILTERS

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Letters

(*Continued from page* 16)

Industrial Products Division.

Mr. William M. Allen, Boeing president, recently said of the Boeing 502 engine and more powerful types in development: "The company's continued activity in this field is a good indication of our faith in the future of this type of powerplant."

GORDON S. WILLIAMS
News Bureau Manager
Boeing Airplane Co.
Seattle, Wash.

Speaking of Records

To the Editor:

You may be interested to know that the Ski Takeoff Weight Record claimed for the Pantobase-equipped YC-123E airplane in your March 26 issue falls exactly 10,135 lbs. short of an unassisted take-off made by a ski-equipped Lockheed P2V-2N Neptune Patrol Bomber from a snow-covered area adjacent to the runways at Ladd Air Force Base, Fairbanks, Alaska, on Thursday, March 29, 1951.

This takeoff made at a gross weight of 65,300 lbs., with neither jato nor water injection, was made after a run of 3,500 feet.

Many ski takeoffs, both assisted and unassisted, at gross weights up to 62,400 lbs. were made during this program from the frozen surface of Lake Harding near Fairbanks. The lake was covered with approximately 40 inches of ice and 36 inches of loose snow.

This particular airplane, and a sister ship, made many operational ski take-offs and landings at gross weights exceeding 55,000 lbs. while assigned to Navy "Project Ski Jump II" operating out of Point Barrow, Alaska, over the Arctic ocean during early 1952, including landing on Ice Island T-3 just 110 miles from the Pole.

Incidentally, both of these airplanes participated in "Project Deepfreeze" near the South Pole early this year.

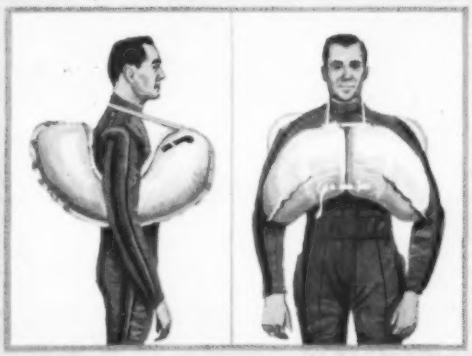
E. B. GIBSON
Lockheed Aircraft Corporation
Burbank, Calif.

Books

TRANSISTORS I. *The Radio Corporation of America Review, David Sarnoff Research Center, Princeton, N. J. 676 pp. Price, $4.50.*

This is a significant contribution to the technology of transistors and related semi-conductor devices. The book comprises many unpublished reports on research and development in transistor manufacture and use. It contains a large percentage of papers never before published, prepared by RCA scientists and engineers.

Among the subjects covered are basic concepts, thermal conversion in germanium, advances in power junction transistors, and circuit applications in amplifiers and counters. In addition the book contains abstracts of 46 papers previously published by RCA scientists.—H. P. S.



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"Survival, Unlimited!"

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Today's fighting man has grown out of his life jacket. It's too bulky and not buoyant enough — with all the rest of his gear — to keep him afloat.

Fortunately, AIR CRUISERS survival research had developed a new design principle: instead of the customary flotation cells around neck and waist, *separate cells under arms, across chest and behind shoulders.*

Result: today's AIR CRUISERS MA II design, above. Compact . . . unhindering . . . vastly superior in flotation characteristics . . . it's the new standard for the Armed Forces.

AIR CRUISERS is America's most experienced fabricator of inflatable rubber and rubberized materials — the manufacturer which conducts continuous research in survival at sea.

Contributing to this specialized science is another division of The Garrett Corporation — AiResearch. From AiResearch laboratories and engineering come integrated components for automatic inflations which are the world's most advanced in design and exacting in quality.

Almost every significant development in survival equipment has had its origin at AIR CRUISERS. Its installations are standard on the world's airlines. There's no limit on quality in its steady advance toward the goal of "Survival Unlimited!"

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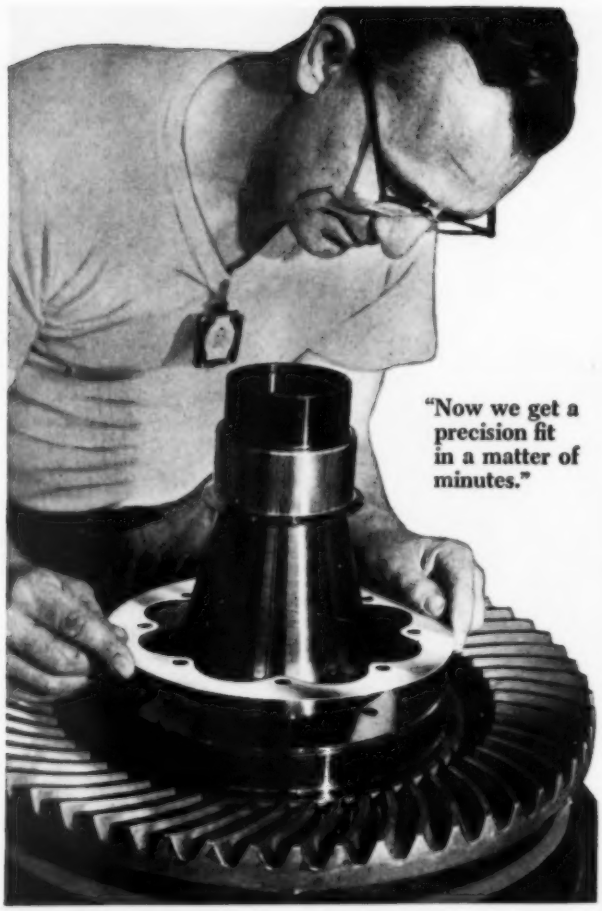

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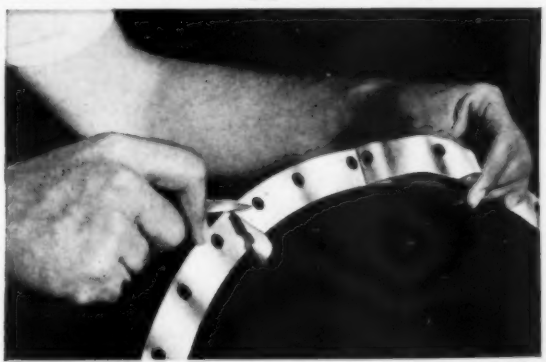
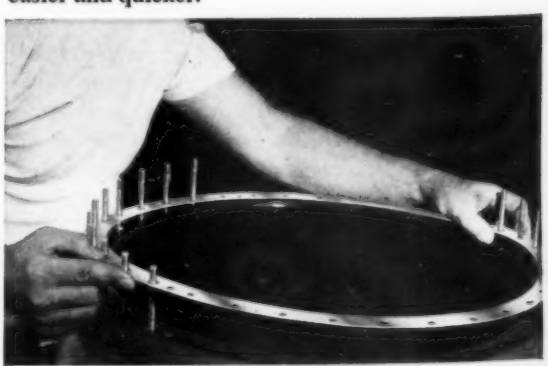


"Laminum Shims simply p-e-e-l for adjustment. The fact that layers come in standard sizes makes our job easier and quicker."



"With Laminum Shims it's no trick to meet close-limit spacing specifications between bearing support and lower housing. Every day we're finding new uses."

Of course we knew aircraft producers have been ordering Laminum Shims for years . . . to obtain accuracy, save time and cut costs. However, we weren't quite sure ourselves just exactly how they were applied, nor what advantages appealed most to our customers. So we went out and asked.

Here are the answers—not what *we* say, but what *they* say:

"Laminum Shims have done away with grinding and costly micrometer checking. They've streamlined production. Eliminated metallurgical contamination. Simplified inventory. Reduced machining requirements."

"With Laminum Shims the problem of precision fitting is reduced to simply peeling off the layers to the desired thickness. Now we hold tolerances to a thousandth."

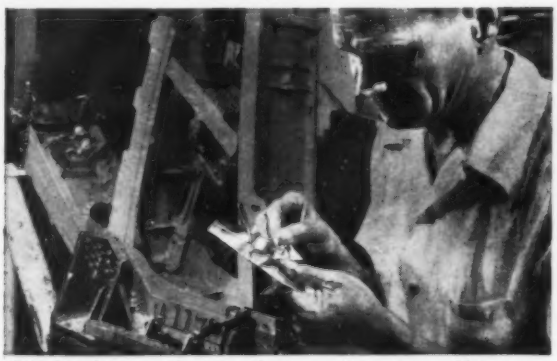
"Any application requiring shims of varying thicknesses is made to order for Laminum Shims."

"To accurately and efficiently control space tolerances in critical placement throughout our aircraft, we have shifted to the extensive use of Laminum."

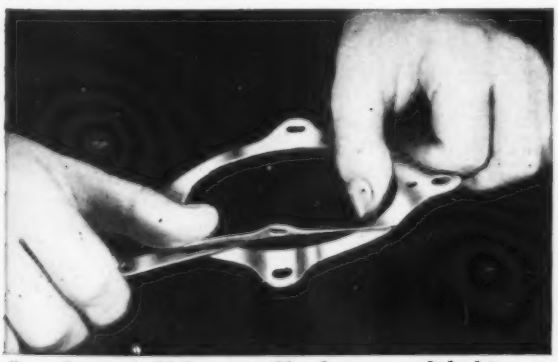
tell . . . in their own words . . . why

Shims cut assembly time 35%"

"Six-inch diameter Laminum Shims are easily sized to exactly .065" in overall thickness. It really saves time over the old grinding-down method."



"To fit ribs exactly into the spar, Laminum Shims are scored into quarters, and varying thicknesses are peeled off each quarter."



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RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

4 hot recipes that do away with icing

SOME of these recipes for ice protection require more heat than others. But all of them call for B. F. Goodrich electrically heated rubber to give just the right amount of heat—in the right places.

Notice how B. F. Goodrich heated rubber fits snugly around the tricky curves and corners on these different airplane parts. And how the ice problem was solved in each case:

1. *On propellers,* it prevents ice from reducing propeller efficiency and cutting down plane speed.
2. *On reel oil coolers,* like these on the KB-50 (Hayes modification), it keeps ice from choking off vital air supply.
3. *On air intakes,* it insures smooth flow of air to engine parts and cabin heating system.
4. *On pitot mast,* it prevents ice from clogging air speed indicator and giving faulty readings on instrument panel.

In B. F. Goodrich heated rubber, resistance wires are sandwiched between rubber plies, then vulcanized into a flexible, lightweight unit. It can be easily cemented on the part or attached mechanically.

Other heated rubber applications for ice protection or heat control include antenna masts, wing and empennage leading edges, spinner domes, jet engine air intakes, and radar equipment.

If you are looking for the most efficient method of applying spot heat, consult a B. F. Goodrich engineer. He'll be pleased to help. *B. F. Goodrich Company Tire and Equipment Division, Aeronautical Sales, Akron, Ohio.*

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ESTABLISHED JUNE 1, 1937

World's Largest Aviation Publishers
American Aviation

VOL. 19, NO. 24

OPPORTUNITIES UNLIMITED, BUT THERE ARE HAZARDS

Airlines' Future Hinges on Federal Policies

Traffic, earnings and revenues soared to new highs in 1955, but politics continue to hamper operations of CAB and CAA.

By WILLIAM V. HENZEY

With the number of problems growing as fast as new operating records are being set, the U.S. airline industry has barreled into a so-called transition period with success mandatory but not guaranteed.

A great many of the problems bear a strong relationship to a Federal government attitude which, during the past year, has ranged from alarming disinterest to one of open hostility.

In short, it is a picture of a highly successful industry being on the threshold of much greater achievements but lacking a vote of confidence from its own government.

• **No industry crying-towel** would appear necessary. Last year, traffic exceeded all previous records and revenues and earnings reached new highs. This year, the favorable trend is expected to continue.

But unlike many businesses with but one plateau of success, the airline industry is still walking the hazardous steps to a pinnacle unknown to man. Earnings are necessary investment tools with which to continue the upward climb.

U.S. Supremacy at Stake

Next step up, of course, is the commercial jet age which, on the basis of last year's initial orders for jet transports, is three years away. Thus, the favorable revenue and traffic trends of the past two years must continue unabated if a healthy industry is to uphold U.S. prestige and supremacy in the commercial air field.

Aside from what harm a disinterested or hostile government attitude can inflict, here is what airline managements are faced with as they look ahead to the jet age.

• **As profits grow**—and the 1955 operating income was a record $130 million—so do the demands for such monies as industry must (1) plough back enormous sums to meet ever-increasing equipment needs of the present and future, and (2) compensate stockholders for their investment to remove aviation from the speculative investment category.

These, of course, are in addition to the many technological, operating, and competitive problems that have developed in the past year. But if earnings are threatened by ill-timed or ill-advised actions by the government, the U.S.

Rate of Return on Average Total Investment
Domestic Trunk Air Carriers, 1939-1955
(Domestic Operations Only)

(In per cent)

Year	Domestic trunk group [3]	American	Braniff	Capital	Colonial	Continental	Delta	Eastern	National	Northeast	Northwest	TWA	United	Western
1939 [2]	2.3	20.1	10.7	3.9	[4]	8.0	31.7	16.3	0.7	—1.6	—6.3	—9.6	—3.7	—9.1
1940 [2]	13.2	29.6	8.8	8.8	[4]	10.0	20.2	17.8	6.9	3.5	16.6	5.8	8.8	7.3
1941 [2]	4.5	17.4	—8.0	—11.6	21.7 [4]	—8.2	—0.3	18.0	1.6	—8.8	16.0	—16.2	—0.9	0.6
July-Dec. 1941	14.1	21.4	5.4	16.2	45.8	1.1	21.4	15.7	5.8	—13.9	19.4	6.2	14.4	3.1
1942	20.3	22.9	34.6	11.4	17.2	26.2	19.8	16.3	27.7	24.2	23.7	21.6	19.6	12.6
1943	17.1	24.6	7.9	7.3	2.6	31.1	31.7	10.0	2.6	—7.1	22.1	16.8	21.2	5.2
1944	17.5	22.5	12.1	9.8	—4.4	14.2	34.8	9.0	—1.9	—3.8	18.0	18.1	23.7	10.4
1945	9.4	15.8	11.8	5.6	10.3	34.0	21.5	11.6	4.4	10.9	12.4	—7.6	12.4	8.2
1946	—1.5	—0.3	3.2	—15.9	—12.7	2.1	—2.6	20.4	14.4	12.6	—0.4	—29.9	4.8	—7.9
1947	—3.1	—1.8	2.1	—10.5	—10.4	5.1	1.4	6.8	—2.9	—45.6	—5.5	—10.4	—4.2	—14.6
1948	—1.9	—1.4	5.4	6.5	—13.3	5.0	5.2	7.3	—29.6	—7.0	—6.3	—6.5	—4.4	—4.1
1949	5.9	5.4	6.2	21.2	—9.5	9.1	5.7	5.9	—5.5	1.6	0.9	4.2	3.7	4.1
1950	12.4	12.1	18.5	13.7	—22.9	7.6	13.2	14.6	31.2	10.4	6.3	10.7	13.4	8.8
1951	14.9	11.5	22.7	16.6	—12.7	13.4	21.6	15.7	37.4	4.8	8.1	15.4	18.0	18.0
1952	13.1	12.8	19.1	12.3	—14.7	16.0	36.4	11.8	25.0	—0.7	3.5	12.0	13.1	11.6
1953	10.9	12.2	11.0	12.7	5.3	17.2	5.0	9.5	26.9	19.4	7.9	8.7	9.8	8.4
1954	10.6	12.9	16.0	9.0	—0.7	8.4	9.0	9.2	7.9	2.9	9.5	13.5	6.6	11.8
1955 [2]	12.6	14.5	17.4	30.6	—4.6	7.5	9.2	12.6	13.3	1.2	12.5	12.0	9.3	13.9

[1] Based on net profit after income taxes, before interest charges and preferred dividends.
[2] 12 months ended June 30.
[3] Weighted average—sum of net profit divided by sum of average investment.
[4] Complete financial reports for 1939-1941 are not available. Data for 1941 cover the period beginning with January.

Source: Civil Aeronautics Board

Net Profit of Domestic Trunk Carriers, 1939-1955

(Domestic Operations Only)

(In thousands)

Year	Domestic trunk group	American	Braniff	Capital	Chicago & Southern	Colonial	Continental	Delta	Eastern	Inland	Mid-Continent	National	Northeast	Northwest	TWA	United	Western
1939[3]	$ 730	$1,045	$ 61	$ 30	$ 77	$ [4]	$ 21	$ 53	$ 573	$ 2	$—29	$ 3	$ —7	$—103	$—509	$—421	$—66
1940[3]	5,254	1,953	89	124	42	[4]	37	57	1,030	—11	32	31	14	295	346	1,062	153
1941[3]	2,310	1,970	—122	—269	—7	59[5]	—56	—2	1,612	12	—137	10	—52	313	—916	—119	14
July-Dec. 1941	4,284	1,614	45	242	36	136	5	95	803	18	—103	22	—56	194	215	982	36
1942	14,525	3,851	652	409	275	112	242	188	1,892	—4	254	206	192	531	2,219	3,157	340
1943	14,862	4,944	369	285	136	17	308	379	1,427	4	174	20	—100	493	2,097	4,215	94
1944	19,552	5,397	871	407	128	—29	158	553	1,504	—56	129	—29	—76	635	2,741	7,026	193
1945	13,879	4,339	859	535	172	85	494	657	2,127	16	179	147	212	929	—1,750	4,670	208
1946	—3,086	—176	233	—2,118	—462	—215	35	—107	4,452	—40	279	788	242	—45	—7,486	1,806	—272
1947	—8,504	—1,830	189	—1,114	—96	—224	102	74	1,760	—28	275	—197	—561	—764	—2,896	—3,361	—831
1948	—5,761	—1,336	369	626	459	—241	147	430	2,337	54	121	—1,789	—130	—1,146	—2,208	—3,330	—324
1949	19,119	7,916	541	2,051	471	—176	300	548	2,085	314	347	—288	61	213	1,875	2,737	314
1950	41,023	11,629	1,405	1,418	673	—402	233	1,215	5,168	285	402	2,189	440	1,744	4,683	9,281	460
1951	52,268	11,483	1,570	1,907	633	—208	420	2,054	7,779	115	456	3,165	188	1,809	7,534	11,981	1,382
1952	58,295	13,599	1,990	1,537	768	—209	646	4,429	8,388	[6]	[7]	3,770	—28	781	7,961	13,342	1,321
1953	55,964	14,137	2,227	1,829	[8]	80	1,284	1,247	8,013	....	.....	6,225	829	1,631	6,469	10,811	1,182
1954	58,296	15,823	3,651	1,536	....	—11	694	3,186	7,979	....	.....	2,077	138	1,829	8,985	10,790	1,619
1955[3]	72,716	18,741	3,896	5,755	.....	—77	635	3,498	11,383	....	.....	3,507	49	2,633	8,093	12,452	2,151

[1] Net profit after income taxes, before interest charges and preferred dividends. Net profits for 1939-1951 reflect an adjustment of mail payments (including subsidy) from period in which reported to period in which earned. Net profits for 1952-1955 are as reported, including surplus adjustments reported for each year.

[2] 12 months ended June 30.

[3] Complete financial reports for 1939-1941 are not available. Data for 1941 covers the period beginning with January.

[4] Inland merged with Western April 10, 1952.

[5] Mid-Continent merged with Braniff August 15, 1952.

[6] Chicago and Southern merged with Delta May 1, 1953.

Source: 1939-1951 data—from Exhibit BC-3, General Passenger Fare Investigation, Docket No. 5509.
1952-1955 data—from a recent tabulation derived from carrier reports on CAB Form 41.

Civil Aeronautics Board

companies may well be sitting back and watching Britain, Russia, or some other powerful nation lead the way into the jet age.

• **In what areas** may the industry be harmed by government action or inaction? One very prominent area is Congress, where a powerful House committee currently is planning on directing the Civil Aeronautics Board to institute a general passenger fare investigation and no one has in mind that such a directive contemplates a result other than an enforced reduction in fares.

Another such area is the executive branch where inactivity or disinterest may be more damaging in the long run than any direct action by Congress.

In 1955, for example, U.S. certificated airlines placed orders for more than $1 billion worth of new aircraft and facilities in one of the year's most impressive displays of confidence in the economy of the nation. This confidence was shared by banks, insurance firms, and other investing agencies who participated in long-term financing arrangements.

Too Much Politics

The executive branch of the government, however, continued to apply a firm rule against putting anyone with industry knowledge or affiliation in responsible government spots even though on such men hinges, to a great extent, the future of aviation in this country.

The policy might be interpreted as the result of a belief that there is not an honest man in the airline industry, or with knowledge of the business, to be trusted with a government job. But it most likely stems from the fact that the Administration has not yet exhausted the patronage list it inherited four years ago.

• **At any rate,** lame ducks, unestablished lawyers, economists and the like are asked to assume expert roles over an industry with which they are totally unfamiliar.

There have been a few exceptions to the policy but the CAB, for one, continues to be a payoff Utopia for political debts.

Small wonder then that Congress, in addition to its expected attack on fare structures and earnings, would start considering legislation which would permit the courts to challenge the so-called "expert" findings of the government's regulatory bodies.

• **Now, as in the past,** the courts correct errors in the administration of law committed by Federal agencies but refuse to reverse findings on which they consider the government bodies to be expert. The courts could go beyond such a limited function if pending legislation is passed.

Also inherent in the Congressional pressure for a fare investigation is government control of airline earnings. If the attitude of a CAB majority over the past six months is any gauge, such control could be harmful, if not disastrous.

The government, of course, has every right, in fact a duty to insure the public against unreasonable profits by a regulated utility. And if the industry were vulnerable to claims of overcharging the public to further its own profits there would obviously be no alarm, and certainly little defense against the government stepping in.

But air travel is one of the big bargains of the day, profits are earmarked either directly or indirectly for investments in service improvements, and the prestige of the country in air matters is riding on the balance that management and government can achieve.

Competition Keener

• **Last year,** competition was stepped up throughout the U.S. airline industry. The nation's 13 local service airlines were made a permanent part of the air route map after nine years of struggle under temporary licenses.

Six regional trunklines were granted important route extensions, as were three of the Big Four carriers with the CAB-announced idea of closing the gap between the regionals and the Big Four.

The non-scheduled airline industry was granted a new and more liberal form of operating license, the full effect

of which won't be felt until the present tight equipment situation eases to permit full use of the new authority. Nonskeds estimate it will be about a year before that situation eases.

Freight forwarders were given a new lease on life domestically, and this year, two new cargo lines have been certificated for operations in the eastern half of the nation (Riddle Airlines and American Air Export & Import Co.) and the two transcontinental cargo carriers (Slick and Flying Tigers) have been granted renewed licenses. All four also were granted first-time authority to carry air mail and air express.

Across the Atlantic, Seaboard & Western Airlines has been certificated for all-cargo operations.

• **The competitive pace** also is certain to be stepped up further when CAB decisions are issued in such pending cases as the New York-Florida Case, Great Lakes-Southeast, St. Louis-New York Nonstop, St. Louis-Southeast, Phoenix Service, Seven States Area, Great Lakes Area, and Pacific Northwest Area, to name the more important.

One cannot look objectively at any or all of those developments and be too critical. Nor can one look and say that the public interest and the industry will be better served.

In view of all the undigested competition added to the industry, there is much concern in knowledgeable quarters of CAB over what an enforced fare reduction might do to the industry.

When Cutting is Dangerous

It is considered sound theory in those quarters that you don't expand routes and cut prices at the same time. An industry with all routes properly developed usually can withstand fare reductions; in fact, may benefit by them. But an industry with such a high percentage of undeveloped routes as the domestic trunk industry at the present time, could be inviting disaster by cutting, or being forced to cut fares.

Also, it is generally overlooked that the continued expansion of coach service is a constantly-spreading fare reduction. Coach fares are approximately two-thirds of first-class fares. In 1955, coach passenger-miles of the domestic trunks grew to 34.92% of total passenger-miles. Thus, more than one-third of industry traffic is being carried for two-thirds the money.

Total coach traffic last year was over 6.6 billion passenger-miles or more than total industry passenger-miles in 1949. In six years, therefore, a market greater than the total in 1949 was carried at two-thirds the price.

• **Highly significant expansion** of coach service is in the offing for this spring with American Airlines' announced plan to start Douglas DC-7 nonstop coach flights between New York and Los Angeles. Heretofore, the DC-7 has been strictly the No. 1 first-class ship of American and many other lines.

Trans World Airlines' current No. 1 ship, the Lockheed Super-G Constellation, was placed in combination coach-first class service last Fall.

All in all, the industry is continuing to turn out its product in greater volume and at less cost to the public, while the charges of the competing rail industry continue to go up.

• **The industry's hope,** therefore, is that the Federal Government doesn't short-change itself, for the public interest can only be truly served if the industry is in sound enough shape to give it the service and progress the American taxpayer demands and deserves.

The taxpayers have invested millions in subsidy in the past to develop the industry to the self-sufficient status it enjoys today. There are upwards of 200,000 individual shareholders who have invested private funds in the national certificated system, whose assets last year exceeded $1.3 billion.

There are over 125,000 employes in the U.S. certificated airline industry with an annual payroll of close to $650 million. Much hinges on a continued upward climb. The government, which averaged $60 million annually from the business in income taxes alone, has a very vital stake. Its intelligent interest and confidence is necessary. ◆◆◆

Air Traffic Continued Upward Spiral In '55; Passengers Carried: 35.3 Million

The ability to fill added capacity led the domestic trunk airline industry last year to its greatest traffic year in history. But with new equipment deliveries this year, a continuation of last year's traffic upswing still in progress, and a marked step-up in coach service, there is every indication that the 1955 records will be short-lived.

Following are the more significant advances made by the trunks last year:

• Total number of passengers carried increased to 35,323,651 from 30,148,931 in 1954.

• Total passenger-miles increased 2.9 billion to 19.1 billion for the year.

• Average industry load factor increased from 63.34% in 1954 to 64.04% in 1955.

• Additional revenue traffic was the equivalent of 75% of added capacity.

• Coach traffic increased 25.2% over 1954 as the ratio of coach to total traffic increased to 34.9% from the 1954 figure of 32.99%.

• Total freight traffic of trunks and all-cargo lines increased from 228.2 million ton-miles in 1954 to 298,422,934 last year.

On an individual carrier basis, American Airlines dominated the field, with more passengers, more passenger-miles, greatest capacity, highest load factor and greatest freight tonnage. United, second to AA in most categories, was first in mail and express tonnage.

Coach Growth Holds Attention

• **In the midst** of all these advances, however, coach development continued to be most important single object of airline managements' attention.

Of apparently temporary significance was the fact that in 1955 *the rate of growth* of coach traffic slowed down for the first time in six years. Coach passenger miles increased 1,344,664,000 to a record total of 6,665,649,000, but the increase was less than the 1.6 billion increase in 1954 over 1953.

Despite the slow-down in rate of growth, coach is still growing faster than other forms of passenger traffic and current developments indicate the pace will be accelerated this year.

No. 1 Planes Used for Coach

• **Feature** of the current developments is the trend among the transcontinental carriers to use their No. 1 aircraft in coach service. Trans World Airlines started the move last fall by providing both coach and first-class accommodations in its Super-G Constellations.

Late this month, TWA is expected to increase the number of coach seats in the Super-Gs from 21 at present to 39.

However, a further increase may be necessitated by American Airlines' proposed inauguration on May 20 of nonstop transcontinental coach service with Douglas DC-7s equipped with 85 seats and a lounge with six supplementary seats.

AA's proposal may force United Air Lines into similar utilization of DC-7 equipment and, assuming CAB permits such expansion, the rate of coach traffic growth should hit a new high this year. Estimated 1956 coach market, if the expansion takes place, is between 8 and 8.5 billion passengers miles.

• **The vital ratio statistic** of coach passenger-miles to total passenger-miles could come close to the 40% mark in 1956. Several years ago, by way of

Coach Traffic Upswing Continues

	Rev. Pass.-Miles—1955 (000) Total	(000) Coach	%	Rev. Pass.-Miles—1954 (000) Total	(000) Coach	%
TWA	2,866,342	1,486,314	51.85	2,611,014	1,370,921	52.21
EAL	3,341,800	1,455,792	43.56	2,847,082	1,167,758	41.02
AA	4,265,962	1,155,235	27.08	3,371,860	754,500	22.37
UAL	3,753,964	1,150,336	30.64	3,134,568	847,225	27.03
NAL	849,169	478,944	56.40	693,947	392,281	56.53
NWA	823,420	295,387	35.87	748,617	293,750	39.24
DAL	952,601	280,977	29.49	786,887	165,378	21.02
WAL	513,880	169,733	33.03	401,313	151,206	37.65
CAP	792,095	117,811	14.87	745,562	146,851	19.69
BNF	604,674	39,906	6.59	525,399	16,296	3.10
CAL	221,223	27,334	12.35	166,540	6,755	4.03
CAI	103,645	7,880	7.60	97,622	8,177	8.37
Totals	19,088,775	6,665,649	34.92	16,130,411	5,320,985	32.99

noting a target, CAB Vice Chairman Joseph P. Adams said the industry should aim at a ratio of 80% coach and 20% first-class or, a complete reversal of the then-existing ratio.

Several industry carriers are approaching the Adams ratio. National Airlines continues to lead the field in this regard with 56.40% of its total passenger-miles in coach service. Trans World Airlines, which leads the industry in coach traffic, is second to National in ratio with a 51.85% figure. Eastern is third with 43.56%, Northwest fourth with 35.87%, and Western fifth with 33.03%.

Also, these significant increases in ratio took place in 1955: American, up from 22.37% to 27.08%; United, up from 27.03% to 30.64%, and Delta, up from 21.02% to 29.49%.

• **Only two trunks** handled less coach traffic last year than in the previous year — Capital Airlines and Colonial Airlines. Capital, however, was in the midst of a re-equipment program centered around its new Viscounts and Colonial was in the last stages of its merger deal with Eastern.

With Braniff, Delta, Capital, Continental, Northwest, and Western in new markets this year, as a result of CAB's new route awards, their participation in the over-all coach market should be increased substantially.

It is significant to note that last year's statistics, which of course do not reflect the route awards, reveal that the coach traffic of any one of the Big Four carriers exceeds the total traffic of any one of the remaining regional lines.

• **In other areas,** the "all-cargo carriers" look forward to a banner year, especially because of the issuance of new domestic certificates to Riddle Airlines and American Air Export & Import Co. and renewed licenses to Slick Airways and The Flying Tiger Line.

The correct new designation for those lines is "property carriers," since they are now authorized to carry airmail and express in addition to cargo.

Not yet possessing mail authorizations, but active in cargo operations in the international field are Aerovias Sud Americana, which operates in the Caribbean area and Seaboard & Western Airlines, which has just activated its transatlantic certificate.

Cargo Tonnage Rises

Cargo tonnage of the four lines operating through 1955—Aerovias, Flying Tiger, Riddle and Slick—increased from 82,205,148 freight ton-miles in 1954 to 122,493,588 last year.

• **In the over-all** cargo picture, Slick ranked second to American in total tonnage with 52.4 million freight ton-miles as compared to AA's 67 million. Flying Tigers ranked third in the industry with 49.8 million, United fourth with 39.5 million, and TWA fifth with 24.4 million.

Riddle, with strong financial backing and active marketing of the New York-Florida market, should produce changes in the top rankings for 1956.

The local service airline industry is breaking all traffic records but still needs equipment and more flexible operating routes. Last year, the 13 local lines carried a half-million more passengers than in 1954. Total passengers for the year were 2,963,936. Revenue passenger-miles were up to 537 million from 473 million in 1954.

• **Most significant** was the rise in passenger load factor from 42.61% to 45.44%. Four of the 13 carriers had a 50% or better load factor: Southwest, 56.23%; Mohawk, 54.89%; Piedmont, 51.74%; and North Central, 50.21%.

Noteworthy in the certificated helicopter field was the increase in passengers carried. Two of the three licensed carriers, Los Angeles Airways and New York Airways, transported passengers and increased their total from 8,971 in 1954 to 29,752 last year.

Helicopter Air Service (Chicago) is currently processing its application before CAB for passenger rights and a decision this year is likely. ◈ ◈ ◈

CAB Asks Comment On Flight Engineer Rule

Civil Aeronautics Board has set May 15 as the deadline for industry comment on a proposed rule change that would drastically alter flight engineer qualification requirements in Part 35 of Civil Air Regulations.

The Board's proposal would also allow use of flight simulators for examining new engineers, but only for demonstration of competency in emergency flight procedures. It would still require applicant engineers to show competence in normal duties aboard an aircraft in flight.

New rules would specify that a flight engineer must have a minimum of five hours training in flight in engineer duties on a multi-engine aircraft having engines of 800 hp minimum. Proposal will also recognize past pilot experience as a qualification—200 hours of pilot-in-command time and 400 hours copilot time for four-engine aircraft or 500 hours command time or 1,000 hours copilot time on twin-engine planes.

Board plan is to give industry opportunity to comment on this proposal as a "discussion draft" before proceeding to the formal step of circulating a rule proposal for comment. Object is to narrow down the points of controversy before issuing notice of planned amendment to the regulations.

BEA, Capital Viscounts Carry Fatigue Meters

Vickers Viscounts operated by both British European Airways and Capital Airlines are fitted with fatigue-measuring instrumentation in the form of counting accelerometers to record all flight gust loads over a certain value.

All but three of BEA's Viscounts carry this type of accelerometer. One Viscount and one Elizabethan use accelerometers which record all loads for analysis purposes. Two Viscounts are fitted with strain recorders.

Of Capital's fleet, about 75% of aircraft in operation have counting accelerometers, but will eventually be fitted with a newer strain range recorder fitted to the bottom boom of the wing spar.

The Viscount study is being conducted in cooperation with the British Royal Aircraft Establishment at Farnborough. It is designed to correlate structural fatigue data with accelerations experienced in actual Viscount operation.

Decisions of '55 Shaped Equipment Pattern

Planes purchased last year will set pace for decade to come; seven U.S. carriers ordered or optioned 146 jets, 84 turboprops

By JOSEPH S. MURPHY

U.S. airlines and aircraft manufacturers entered 1955 with only a vague idea of when the big decision to buy jets actually would come. But—

• Twelve months later seven carriers had ordered or optioned no less than 146 jets and 84 turboprops worth more than $1 billion.

• Foreign sales boosted turbine transport backlog of three manufacturers to $1,104,000,000 and erased the threat that U.S. plane builders might lose the world jet market.

And so the pattern of U.S. airline jet and turboprop operations within the next decade was shaped in 1955.

So many and so spectacular were the year's events that it is difficult to single out one as more significant than the others. It was actually a three-phase re-equipment program all packed into twelve short months.

• **For the first four months,** amid speculation that the first turboprop and jet orders would come before December, U.S. and foreign carriers placed orders with Douglas for 165 DC-6/DC-7 transports worth close to $350 million. By late August the Santa Monica firm had run its backlog to 274 and, near the year end, piston transport orders in 1955 alone totaled 232, valued near the $½ billion mark.

Lockheed Aircraft Corp., after serious consideration of a Model 1449/1549 turboprop Super Constellation powered by Pratt & Whitney T34s, abandoned the idea and proceeded to sell 40 1049s worth about $81 million and 36 new 1649s at $102 million.

Convair, with its late-entry 440, sold 49 at near $40 million in a period when the attraction of a new twin-engine piston transport was generally considered on the wane.

In all, orders taken by the three firms coupled with those for turboprops and jets skyrocketed airline aircraft buying past $1.5 billion, a peak never before approached in their history.

First Came Turboprops

On the turbine transport scene it was first things first. The prospect of real-life operation of a British-built Viscount turboprop on U.S. routes by Capital Airlines was pressing U.S. airlines and manufacturers to come up with an answer.

Although originally slated for April inauguration, CAP actually started service late in July.

• **The big turboprop decision** came on June 10 when American placed an order with Lockheed for 35 new Electras at $65 million less engines. Three months later it settled on the Allison 501 (commercial version of the military T56) and bought 140 at $12.5 million, or about $89,000 apiece.

Close on the heels of AA was Eastern buying 40 Electras worth $100 million and optioning 30 others. Braniff signed up for nine at $22 million. Since then, Lockheed orders and options have swelled above 150 worth better than $300 million. And other major U.S. carriers such as United, Delta, Northwest, TWA, United and Western have yet to make a decision. Only Continental, with an order for 15, has followed Capital's lead in buying Viscounts abroad.

Although the Viscount has been highly successful in attracting sales outside the U.S. (more than 300 have been sold) the dollar value of Lockheed sales of Electras is fast approaching that of the British turboprop. Reason is the big spread in the prices of the two—the Viscount 700 sells for about $840,000 and the 800, which Continental is buying, about $1,090,000. Price tag on the Electra is about $2 million.

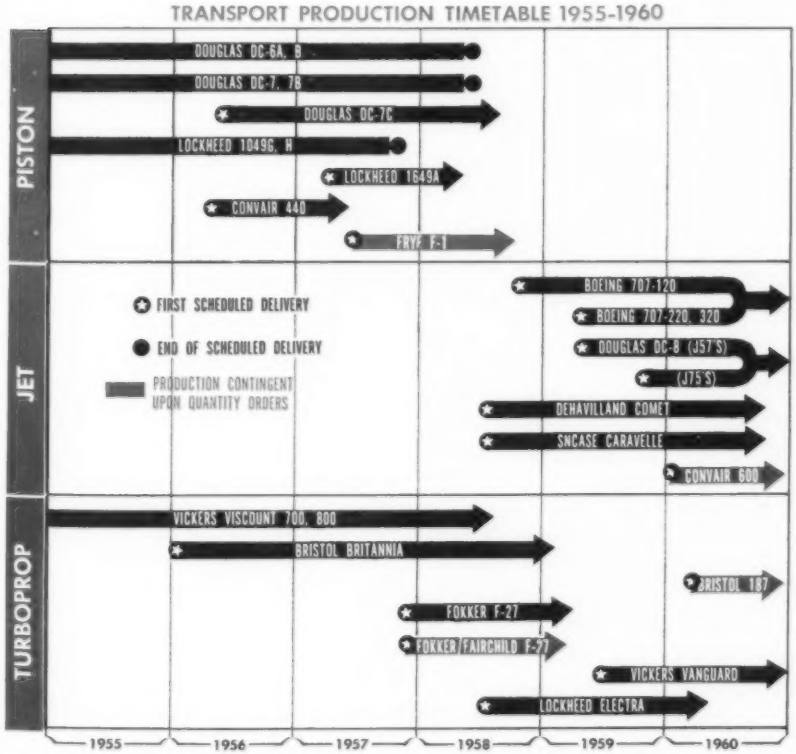
Jets Different Story

With the jets it was altogether a different story. The stern competition that once loomed from Britain's De-Havilland Comet had virtually disappeared with the Comet's grounding. This left a clear field for U.S. manufacturers, but there still remained two big questions: (1) When would the airlines place an order and (2) which manufacturer or manufacturers would be on the receiving end.

• **Answers to these questions** started to take shape early. On March 2 the Air Force gave Boeing the nod as winner of its jet tanker competition, a decision which put the Seattle firm in business as a jet transport competitor.

Without the USAF award and the healthy military contracts (expected to reach $700 million) it brought with it,

TRANSPORT PRODUCTION TIMETABLE 1955-1960



Boeing had only its 707 prototype airplane.

There was serious doubt in many quarters that it would undertake a purely commercial venture in competition with Douglas, especially in a business as expensive and unpredictable as selling a jet.

But even with its AF award in hand Boeing still couldn't offer a jet—it had to have Pentagon clearance to build it in the government-owned Renton plant and had to assure USAF officials that KC-135 deliveries wouldn't suffer.

Douglas Aircraft Co. was probably most instrumental in speeding this clearance when on June 9, the day before American ordered Electras, it announced go-ahead on DC-8 construction. A month later, the Air Force gave Boeing a green light for side-by-side production of KC-135s and 707s, and the sales battle was on.

• **The first order,** by Pan American World Airways on October 13, did nothing but intensify the competition. Pan Am ordered both DC-8s and 707s with a 25-to-20 edge to Douglas. This was later erased in favor of Boeing when PAA altered its order to 12 Intercontinental 707s and 11 shorter range models for a 23-plane total. It also disclosed that four of its 25 DC-8s were ordered for Panagra, making its order two less than that for Boeings.

Twelve days later, a 30-plane DC-8 order by United valued at $175 million gave Douglas the edge. While Boeing was signing up American (November 9) for 30 707s at $135 million, Braniff for five (December 2) at $30 million and Continental for four (December 12) at $21.3 million, Douglas confirmed a National Airlines' order for six DC-8s (November 3) worth $36 million, a KLM order for eight at $52 million (November 16), an order plus option for 26 from Eastern valued at $165 million, and a year-end purchase of seven by Scandinavian Airlines System worth $50 million.

This gave Douglas a 1955 total of 95 sold and seven on option—Boeing 62 sold. At last count, Boeing had closed the gap to 107-84 with sales to Air France (10), Sabena (4) and TWA (8) while Douglas added Delta (6), Japan Air Lines (4), and Swissair (2).

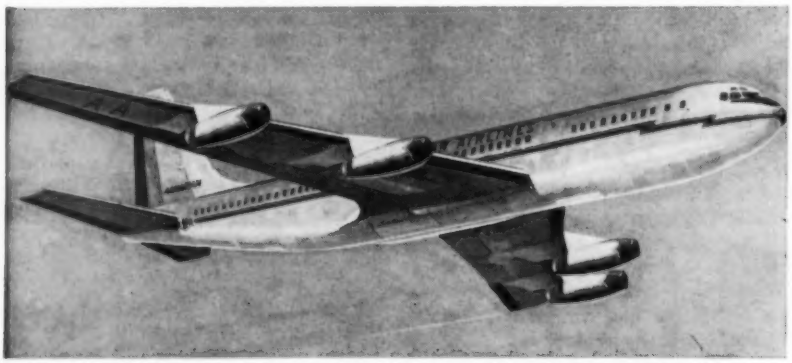
• **Throughout the buying spree** it was Boeing's four advantage points pitted against Douglas' one. Boeing had a prototype, more experience in building large jets, a lower price and an earlier delivery schedule. Douglas, without a prototype, had only its past reputation for building airline transports and a DC-8 jet on paper to match this formidable opposition.

And the competition was not long under way when both aircraft began to change from their original specifications. Boeing's 707, originally grossing 235,000 pounds with a 30,000-pound payload, grew first into a Pratt & Whitney J75-powered version with the same dimensions, then into a 12-foot longer model, the Intercontinental, grossing close to 300,000 pounds.

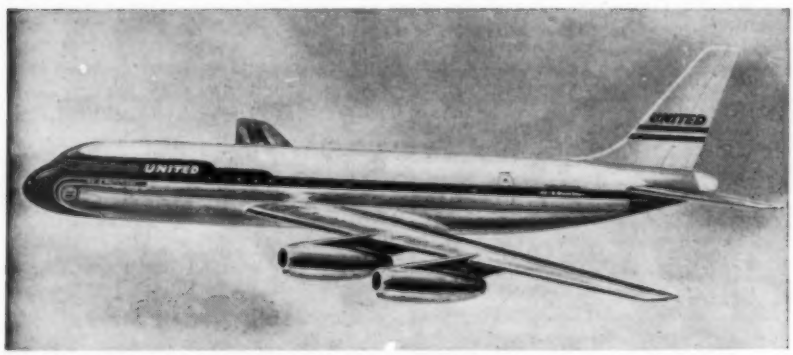
Douglas' DC-8 followed a similar path. Its 211,000-pound domestic and 257,000-pound overseas versions unveiled in June had lost their identity. United's DC-8, when ordered four months later, had the gross pegged at 42,500 pounds. Latest Douglas specifications spell out two domestic models (J57- and J75-powered) at 265,000 gross and two overseas models (J75- and Rolls Royce Conway-powered) at 287,500 pounds. At the same time its length has stretched over eight feet and its wingspan five feet.

Now, with the specifications fairly well settled and with both Douglas and Boeing sales past the breakeven point on jet development costs, the race has settled down to the routine task of winning the few carriers not yet committed.

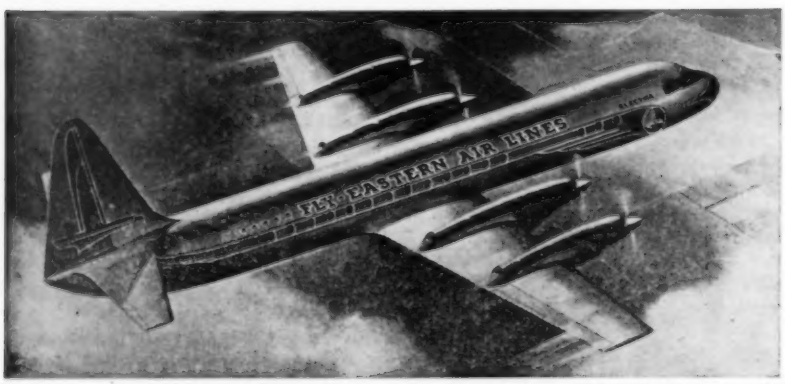
In the U.S. this narrows down to Northwest, Capital, Western and possibly Northeast, although any step by the latter obviously hinges on the final outcome of its bid for a Boston-Miami operation. TWA, which has placed orders for only eight of 30 to be purchased, remains the most attractive customer still to be won.



Biggest Boeing buyer was American with order for thirty 707s valued at $135 million.



United Air Lines led Douglas DC-8 subscribers with 30-plane order worth $175 million.



Top order for Lockheed's turboprop Electra came from Eastern. It bought 40 costing $100 million, optioned 30 others.

• **But regardless** of how these remaining carriers buy, the jet transport era will bring something new to U.S. airline operation. American and United, historically competing with identical aircraft of the Douglas series, will be pitting 707s against DC-8s. Conversely, Eastern and National have followed the pattern of their present-day DC-7 standoff by ordering DC-8s.

On the manufacturing side, it's Douglas and Boeing with jets and Lockheed with turboprops garnering all the business to date. With engines it narrows further, P&W for jets and Allison for turboprops.

But that doesn't mean there aren't others to be heard from.

• **Convair,** once a hot competitor with Lockheed for the turboprop business early this month unveiled its medium-range jet Model 22. Grossing about 170,000, it is slanted at Electra competition, and would use four General Electric J79 engines, introducing a third engine manufacturer on the scene.

And activity at Douglas may not stay all jet. Speculation has persisted for some time that once it passed the breakeven point on DC-8s, Douglas would dust off two pet projects and go hard to work. One is a turboprop (or smaller jet) competitor for the Electra powered by Allison 501s, Rolls Royce RB-109s or possibly Napier Elands. The jet would use P&W J52s.

Douglas' other project, still to materialize into hardware, would be its bid for the "DC-3 replacement" market.

At Lockheed, an entry into the big jet competition looms far down the road, perhaps in the early 1960's. Its original Air Force development contract for an advanced tanker has taken on a new look with emphasis on a supersonic transport, placing Lockheed in a strategic position in the next big round of jet buying, the "707 and DC-8 replacement" era.

But Lockheed has an even stronger commercial prospect ready at hand—the Air Force cargo turboprop C-130 being built by its Georgia Division. Lockheed has authorized a commercial sales program on the C-130, and although AF clearance would be needed before actual production could be committed, capacity at Marietta can handle all the C-130s the USAF wants and still permit commercial deliveries as early as 1958. Price of the civil C-130 is reportedly in the same class as the Electra, about $2 milion.

Still No 'DC-3 Replacement'

The only key area in which 1955 did not produce a firm program was that of the "DC-3 replacement" although permanent certification of the U.S. local service airlines brought this activity to an all-time peak.

1955's Top Ten Transport Events

In their order of occurrence, these ten transport developments played a major role in making 1955 U.S. aviation's year of big decisions:

March 2—Boeing KC-135 wins USAF jet tanker competition, putting the Seattle firm in the commercial jet competition to stay.

June 9—Douglas announces go-ahead on DC-8 construction, starts sales campaign.

June 10—American Airlines buys 35 Lockheed Electra turboprops at $65 million (less engines); later orders 140 Allison 501s at $12.5 million.

July 13—Air Force gives Boeing go-ahead to build commercial jet side-by-side with KC-135.

Sept. 27—Eastern Air Lines orders 40 Electras valued at $100 million, options 30 more.

Oct. 13—Pan American orders 20 Boeing 707s and 25 DC-8s for $269 million total. Later increases Boeing order.

Oct. 25—United Air Lines orders 30 DC-8s worth $175 million.

Nov. 9—American Airlines buys 30 Boeing 707s valued at about $135 million.

Nov. 16—Douglas registers first foreign purchase of American-built jet with $52-million order from KLM for eight DC-8s.

Dec. 7—Eastern orders 18 DC-8s, options eight others, for $165 million total. Later changes order to 19 to give Douglas billion-dollar year for commercial transport orders.

Pending some formal entry by Douglas, the competition for this market now shapes up as a battle between Fairchild/Fokker with an Americanized F-27 twin-turboprop Friendship, Britain's Handley Page Herald, powered by four 870-hp Alvis Leonides Majors, and the new Frye F-1 Safari, a four-engine short-field transport grossing up to 37,000 pounds and capable of carrying 51 passengers.

• **Leading contender** so far is the F-27, with four U.S. carriers already talking plans for its use. Mackey Airlines has ordered two and optioned two others. West Coast has taken an option on six. Southwest and Bonanza have both told CAB they plan introduction about 1958.

Next in line is The Frye Corp. with its F-1 Safari. It has received definite commitments for six F-1s with options for more from two Alaskan airlines—Northern Consolidated and Wien Alaska. Like U.S. production of the F-27, the F-1's future rests upon receipt of sufficient orders to warrant production.

Douglas' bid, when it comes, is expected to be an STOL (short take-off/landing) design for short-field operation. Features reportedly involve a straight, high wing, large wing area, big flaps, with "still secret" devices aiding them in producing short takeoff and landing performance. Reports are that Douglas may employ a form of "hinged" wing to accomplish this.

• **In the other major area** of short-haul transportation, Sikorsky Aircraft has broken into the lead over its competition (Vertol and Bell) with an order from New York Airways for seven of its 12-passenger S-58s for introduction in mid-June this year.

Vertol (formerly Piasecki Helicopter Corp.) during the year unveiled its PH-42, a 16-19 passenger helicopter and sought CAA certification. Early this year, however, approved activity was suspended until a multi-engine version is available. This latter design is understood to involve use of two General Electric T58 "turboprop" engines.

Bell's bid for the commercial helicopter market will probably involve two designs. One, the Model 204, is a commercial version of the Army's XH-40 (4-to-7-place) powered by Lycoming's T53 free turbine. The other is the Model D-216, a 25-passenger proposal using three turbines for power. It would have a tandem rotor arrangement aimed at cutting helicopter direct operating costs to about 10¢ per available seat mile. ◆◆◆

MATS Plans to Sell Trip Insurance

With its accident rate at a new low, Military Air Transport Service is arranging to sell trip insurance to passengers on scheduled MATS routes.

The 1955 accident rate dropped to 6.06 per 100,000 flying hours. Transport operations, which totaled about half of MATS's flying hours, accounted for only 20% of the accidents. Remaining 80% were in jet training, weather reconnaissance and air rescue.

Mutual of Omaha insurance will be available in April. Tele-Trip Policy Co., Mutual subsidiary, will sell policies at MATS and civil terminals in U.S. American Express will handle sales overseas.

NEXT FIVE YEARS WON'T BE EASY BUT—

Airlines Are Prepared to Cope with Jet Age

Program of personnel expansion and training must be undertaken to meet anticipated traffic growth and operational problems.

By W. A. PATTERSON
President of United Air Lines, Inc.

ANY airline management which has just committed itself to one hundred million or more dollars worth of jetliners must take a long and hard look at the problems as well as the promises of the much-heralded jet era. And any airline executive must recognize that the jet age no longer is something he can deal with tomorrow. Whether he likes it or not, that age is here.

While the problems ahead are difficult, none is insurmountable. The tremendous technological progress made in the jet field just within the last few years has completely altered what was a rather frustrating picture. Thanks to the genius and drive of our aircraft engine and airplane manufacturers, the jetliner has become a thing of reality which we now know can be fitted into our airline pattern both from an operations and economic standpoint.

Two extremely important steps already have been taken by most of the major air carriers. The first was selection of the types of jetliners which they felt would best serve their purposes. The second was a program of financing the very large expenditures involved.

• **It was no easy task** for any airline management to decide on the make of plane upon which the carrier would perhaps gamble its whole future. There was no service record of any commercial jetliner in this country; much of the data from which evaluations had to be made were largely theoretical, based on many assumptions. And always there was the price to be considered—about $5,000,000 or so per plane. Only 20 years ago, that amount of money bought an entire fleet!

It wasn't a simple task, either, to go out and obtain loans of one hundred million dollars or so. People don't provide that kind of money without being shown a few facts and figures to convince them of the soundness of the venture.

It will forever be a credit to the airline industry that insurance companies, banks and other investors were willing to commit themselves to such financing for the purchases of planes which, to all intents and purposes, still were pretty much on paper. That was

W. A. Patterson

not so much a vote of confidence in the future of jetliners as it was in the experience, resourcefulness, soundness and potentials of the air transportation industry.

That brings us up to the present situation in which we find some 16 air carriers with jetliner orders aggregating over one billion dollars. What are some of the immediate and long-range problems? What changes will the jetliners bring to airline organizations, methods of doing things, overall philosophy?

Obviously, the next four years will be extremely important in terms of preparation by all who will have the responsibility of getting jetliners into operation as smoothly and efficiently as possible. After that will come the big job of proving the jets in service and of merchandising the considerable new capacity which they will offer.

• **Future jetliner operators** must develop a very thorough program of personnel expansion and training to take care of the traffic growth and operational problems which will accompany the transition. For example, flight and ground crews will have to be fully prepared to meet different requirements in the new era.

Just as immediate must be the concern of each carrier and community as to airport facilities to accommodate jetliner operations. There may be an additional 500 or 600 feet required in runway lengths at certain cities; also a need for strengthening runways in some locations. It is the opinion of our people, however, that early planning, as directed by the Civil Aeronautics Administration, has anticipated airport jetliner requirements.

There are the problems of air traffic control and external jet noise which already are receiving much attention and which must be given a great deal more before jetliner service arrives.

Anyone in the business is familiar with the perplexities of air traffic control. Our airways and airport approach areas already are congested; high priority has been given this problem by government agencies as well as by the airline industry. It is to be hoped that early solutions will be found.

As for the noise problem, here again considerable work is in progress by aircraft and engine manufacturer, by the airlines and by other interested agencies to modify what otherwise might prove a source of major irritation to cities receiving jet service. Much progress is being made. We are confident that this problem will be resolved before the critical date of 1959.

• **And what about** the problem of capacity versus payload which will face us in the 1960s? It is apparent that large fleets of jetliners having two or three times the capacity of our present piston-engine planes will increase available ton-miles and probably be out in front of the immediate market. This situation is nothing new to the airline industry. Fleets of airliners must be ordered with the period of their entire useful life in mind. As a consequence, there is likely to be some over-capacity in the early part of their life but this is quickly absorbed by continued traffic growth.

Also, of course, there is the traffic generating effect of new and better equipment. Time after time, down through the years, we have found this factor has tended to upset conservative economic forecasts. Thus I am sure it will be with the jetliner which, in reducing travel times by 35 percent or more and by offering entirely new standards of comfort and efficiency, may well have a revolutionary effect on travel and shipping.

In the intervening years, of course, the market will not be standing still. Our company's forecasts, which closely coincide with those of the CAA, are for 29 billion industry passenger-miles

by 1960 and for 36 billion by 1965 as against less than 20 billion in 1955. That will represent a gain which may well tax our capacity, even with the 331 additional transport airplanes which are to be delivered in 1956, 1957 and 1958.

There are those who, adding up our present fleets plus those 331 piston-engine airplanes on order plus our future jet fleets, come to the conclusion that we have lost touch with reality; that we have embarked on an equipment buying spree which may have disastrous results. They overlook the fact that we will be retiring older piston-type planes as the jets come into service; that we will be taking off the bottom as we add on to the top.

They also overlook, in our opinion, the aggressive character of our industry in terms of serving and selling our product. And they may be overlooking, too, the very substantial traffic generating potential of the jetliner to which I already have referred.

• **It is entirely possible** that United, for example, might dispose of some of our DC-7 fleet, which is most economical in long-haul operations, when the jets get into that field and that we might keep DC-6Bs which are more efficient in the shorter range service than the DC-7s over the shorter distances they cover. Other airlines probably have similar plans. In one way or another, the carriers will tailor their future fleets to reduce any temporary excesses in capacity and yet to provide altogether adequate service for all the various segments of the market—long-haul, medium-haul, short-haul, first-class, coach, excursion and what-not.

An important consideration in serving the medium-haul market will be selection and purchase of turboprop aircraft. Some carriers already are operating or have committed themselves to planes of this type. Others, like United, are awaiting the further development of engines suitable to power the types of planes they have in mind. Many experts are working in this field and we are confident that a suitable powerplant will be evolved. At the appropriate time, we expect to place an order for turboprop aircraft to supplement our long-range turbojets.

Airline executives who now find themselves in the jet age also are finding that they have to make some changes in their way of thinking. Rather more quickly, perhaps, than some of them may have anticipated, they are getting a vehicle which will have a great impact on the social and economic progress of this nation and the world. Long before their customers, they are having to think in terms of 4½ hours from coast-to-coast, 3 1/3 hours between Chicago and the Pacific coast, 4½ hours between California and Hawaii, 6 hours between New York and London and 9 hours between Seattle and Tokyo.

They are having to think about what these speeds will mean in terms of customer demand, new and broad horizons for business and pleasure travel, new concepts of national and international relations. And they must think, too, of such seemingly minor things as how to cut precious seconds from ground time; how to bring electronics to the handling of passengers, baggage and cargo; how to handle up to 150 passengers per jet at two or three gates simultaneously.

These are some of the things which are going to be receiving the concentrated attention of our experts in passenger service and ground operations between now and 1959.

All in all, the picture is one of immense responsibilities and great promises. Certainly, an industry which has come so far in 30 years can be expected to meet the challenge with every success. ◈◈◈

Profitable Transport Helicopter For Airlines Still in Design Stage

The nation's airlines this year are still in a spin trying to figure out when the helicopter manufacturers will be ready to give them large multi-engine transport helicopters capable of making money.

Basically, the situation is still the same as it was 12 months ago: Every rotary-wing producer has paper designs which will satisfy the most discriminating airliner purchaser—on paper. But only two companies have flying articles and both of these suffered delays and setbacks during the year.

• **Sikorsky will soon start** deliveries to New York Airways, Sabena Belgian Airlines and Okanagan Helicopters, Ltd., of its S-58, a 12-passenger single-engine rotorcraft. But the S-58 is not quite what the airlines of the U.S. and the rest of the world are seeking in a transport helicopter.

More closely approaching the ideal are the Vertol H-16 and the Sikorsky HR2S. These military machines, which have passenger capacities of about 40, both employ two engines and plans are under way to convert them to shaft turbines (Allison T56s) instead of piston power plants.

But the YH-16A prototype (two Allison T38s) was destroyed in a crash late in 1955, completely wrecking both the military and the commercial schedule of development.

And the HR2S (commercial S-56) experienced many unanticipated bugs—problems so serious that the Marine Corps Commandant, Gen. Randolph McC. Pate felt forced to tell Congress it would be "years yet" before the Marines have the type of assault helicopter they want.

• **Moreover,** purchase of the S-58 by Sabena and New York Airways caused Vertol to discontinue efforts to get the 20-passenger H-21 certificated for civil use until a multi-engine turbo-rotor (GE T58s) could be evolved to replace the present single reciprocating power plant.

Bell Aircraft at Fort Worth had previously suffered when the Navy cut back orders on its HSL anti-submarine helicopter. Bell is currently offering (AMERICAN AVIATION, March 26) the 25-passenger Model D216, which is powered by three gas turbines and which incorporates many HSL features. But no production of the D216 is likely unless one of the military services sponsors it. ◈◈◈

Convair Bids for Jet Market

Convair's entry in jet competition is this Skylark 600, a 609-mph medium range transport powered by General Electric CJ805 (J79) engines. Gross weight is pegged at 170,000 pounds, passenger capacity 80 to 99 and payload between 19,700 and 22,835 pounds. For more details see (AMERICAN AVIATION, Apr. 9.)

Airline Financial Needs Remain Unfilled

Planning for future requirements can be decisive factor, as experience of American Airlines from 1946 onward shows.

By SELIG ALTSCHUL

Most of the public attention on the airline front has been attracted by the announcements of new jet transports ordered in recent months. Thus far, new equipment in the turbine transport family entail commitments in excess of $1.5 billion.

Deliveries of the turboprops are continuing on the Viscounts for Capital and are scheduled to accelerate with the Electras in 1958 for Eastern, American and Braniff. Starting in mid-1959, the jets are scheduled to make their appearance first with the 7-0-7 to be followed in 1960 by the DC8.

Not to be overlooked are the orders for conventional piston-powered aircraft, aggregating about 259 in number and representing some 103 DC7s, 74 DC6Bs, 42 Constellations, 19 Convairs, 11 DC6As and 10 Constellation cargo versions. These planes will entail capital expenditures of around $350 million and are to be delivered during the next three years through 1958.

• Substantial capital requirements are involved by the separate airlines with new equipment on order. While a few carriers have anticipated much of their future commitments, many carriers have yet to outline their financial plans. In fact, some airlines have not even ordered jet aircraft and will ultimately add to the industry's financial requirements.

With scheduled deliveries of most jets four and five years away, the industry does have an important time factor as a cushion in anticipating its capital requirements. This is tempered, of course, by the degree of progress payments that must be made in the interim.

Financing Key Factor

• It is becoming clearly evident that, in viewing the outlook for any airline, financing arrangements to meet future requirements are emerging as a key factor. No longer, if ever, can management regard financial elements as separate and distinct from operations, equipment and other considerations. Nor it is a matter to be resolved as a mere detail on the first available afternoon.

Imaginative financial planning frequently can be the determining influence in setting a successful operational course for a carrier. The experience of American Airlines ten years ago is a case in point.

U.S. Airlines Selected Financial Data as of Sept. 30, 1955

(000 omitted from all dollar amounts)

	Total Assets	Net Worth	Long-Term Debt	Debt Ratio	Operating Prop. & Equip. (Depreciated)	% of Book Cost
American	$203,012	$114,309	$ 30,000	20.8%	$ 80,564	42.3%
Braniff	31,701	23,698	17	..	20,166	55.5
Capital	29,070	16,821	1,459	7.9	14,096	47.6
Colonial	3,943	2,289	36	..	1,363	28.7
Continental	12,279	5,397	2,575	32.3	6,242	56.0
Delta	54,310	23,056	15,119	39.6	31,824	58.2
Eastern	156,894	65,445	27,000	29.2	57,933	38.1
National	37,600	21,155	7,844	27.0	23,761	62.8
Northeast	7,181	4,928	....	..	2,901	39.8
Northwest	51,375	28,291	8,750	23.6	31,609	47.1
Pan American	253,411	120,935	41,950	25.7	109,293	N.A.
T.W.A.	157,518	72,244	35,000	33.2	98,546	46.8
United	201,098	104,378	37,013	26.1	125,304	58.4
Western	24,499	12,280	3,884	24.0	11,686	49.9
Allegheny	2,983	1,238	619	33.3	1,750	49.9
Bonanza	1,274	574	124	17.7	706	63.2
Central	1,164	406	120	28.1	395	40.7
Frontier	1,696	520	227	30.3	570	25.5
Lake Central	983	39	160	80.4	451	60.2
Mohawk	3,090	1,384	1,125	44.8	2,026	69.2
North Central	2,900	898	425	32.1	1,352	46.0
Ozark	2,097	792	200	20.1	1,027	50.0
Piedmont	2,930	1,631	....	..	998	44.2
Southern	1,522	684	135	16.4	646	46.7
Southwest	2,958	1,436	477	24.9	1,751	51.3
Trans-Texas	1,646	736	25	3.2	751	53.6
West Coast	1,617	732	14	1.8	938	47.2

In 1946, American sold $80 million in new securities, $40 million in 3% debentures and $40 million in 3½% convertible preferred stock. In so doing, American, through its underwriters, obtained the lowest interest ever accorded any airline debt financing as well as the lowest dividend rate for an airline preferred stock. The twenty-year maturity on the debentures was also the longest that appeared on an airline obligation at that time.

• Armed with this $80 million, American was able to proceed aggressively with a program calling for the acquisition of fleets of DC6s and Convair 240s, the first new postwar equipment to be ordered. In the interim, too, this new money permitted the company to ride out 1946 and 1947, when heavy deficits were incurred.

The financial ability of American to obtain this new equipment gave it the means to seize a competitive advantage. With its then modern aircraft, the company was able to so schedule its flights to best advantage in creating new traffic as well as diverting business from its competitors.

For many years, until the equipment picture was brought into closer balance, American's competitors were hard-pressed to recover their share of the airline market.

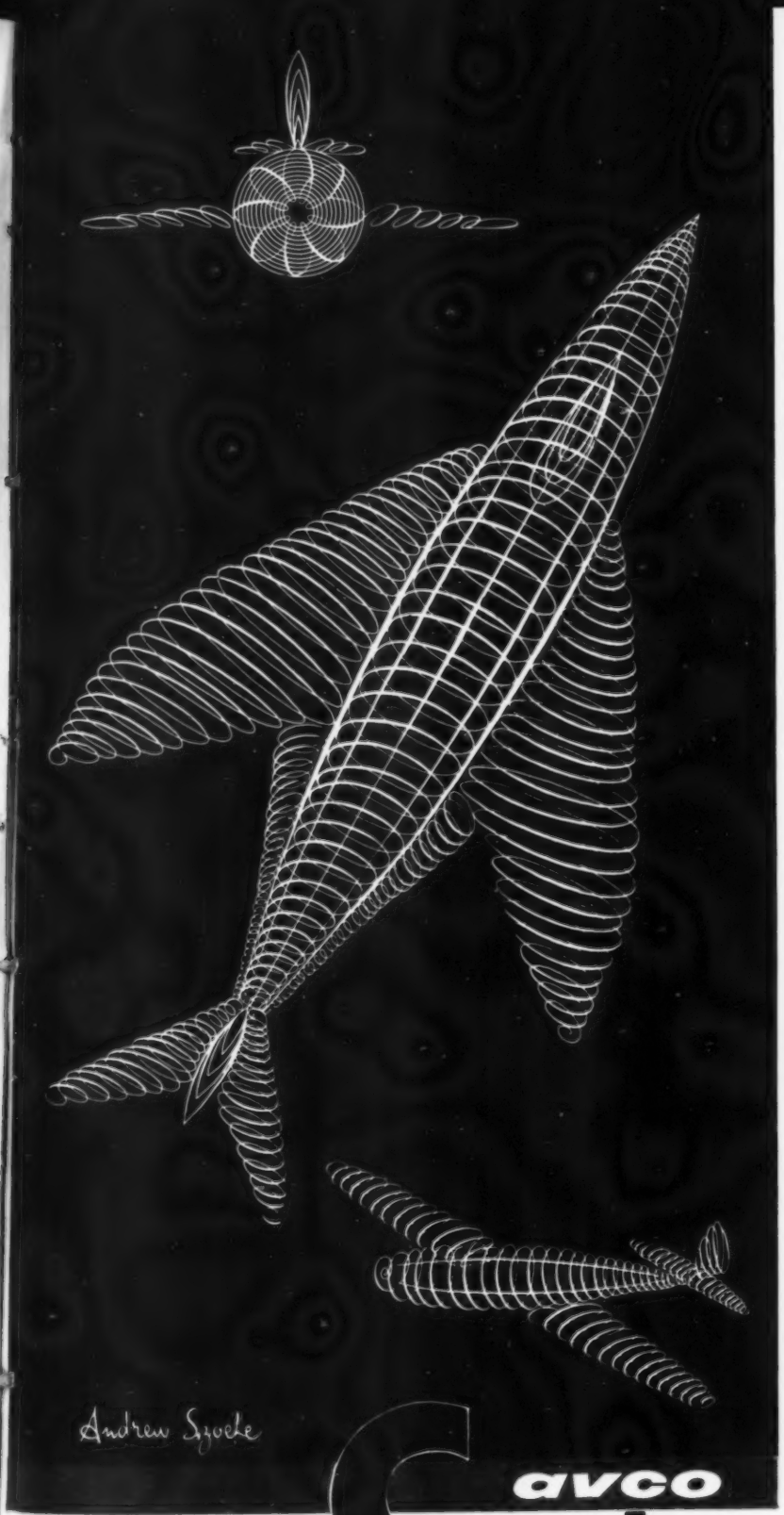
Lesson Remembered

• This lesson has not been lost on the industry. It is a circumstance accentuated by the sharp upward trend of traffic in recent years and the current shortage of capacity available to many airlines.

Capital expenditures by no means will stop with the aircraft itself. In addition, there will be substantial expenditures necessary to supplement and support the operation, servicing and maintenance of this aircraft.

For example, maintenance facilities

(*Continued on page 39*)



Avco Crosley helps bring a new anatomy of flight to life

Today, new breeds of planes are filling America's skies! In a brief decade of bold experimentation inspired by the military, the aircraft industry has created swept-winged, smooth-skinned new speedsters of almost unrecognizable sleekness.

Throughout this spectacular evolution, Avco's Crosley division has contributed "components," even entire airframes—in ever-mounting volume, for everything from small utility planes to giant trans-continental bombers. And to reproduce aircraft anatomy with perfect fidelity to design, a new Crosley method (the Avco Axiomatic System) guarantees complete interchangeability of components, even from the first unit built.

Through advances in airframes—as well as in scores of electronic instruments—Avco Crosley translates practical engineering experiences into finer products and brilliant new possibilities . . . for an America strong in peace.

3 Crosley booklets (Aircraft Structures, Honeycomb Concept, Axiomatic) detail ways Crosley's airframe capabilities can help you. Write for them to: Avco Defense and Industrial Products, Stratford, Conn.

ENGINEERS WANTED: For top-flight men, Crosley offers unusual opportunities to explore new scientific frontiers that lead to outstanding and rewarding careers. Write to Director of Engineering, Crosley Government Products, Cincinnati 15, Ohio.

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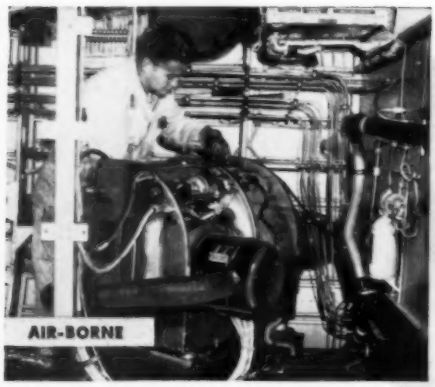
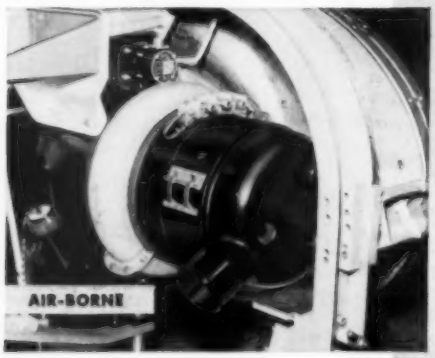


On the Douglas C-124C *Globemaster*, Solar Aircraft Company "Mars" APU's, using G32 machines, have logged more than 40,000 hours with overhauls scheduled at 750 hours.

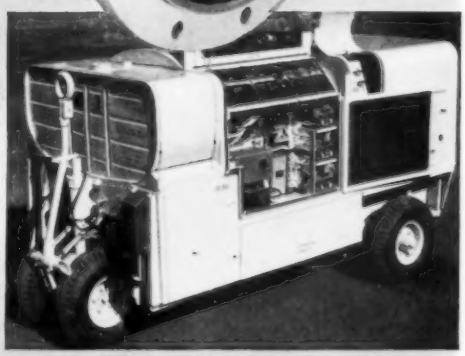
J&H Model G32 d-c Generator.



Pod-hung "Mars" APU's by Solar provide a-c and d-c power for the testing of advanced electronic gear aboard the Convair C-131B "Flying Laboratory."

GROUND

USAF type MD-3 GPU's (right) for aircraft starting, ground test and servicing use three G32-3's. They are manufactured by Beech Aircraft Corporation and Consolidated.



J&H Generators are easily identified in this view of the MD-3 Ground Power Unit assembly line at Consolidated Diesel Electric Corporation.

SHIPBOARD

An important G32 application may be seen on any Navy carrier deck. Self-propelled "Jeep" type mobile power units (below), manufactured by O. E. Szekely & Associates, provide fast starting for getting Navy fighters in the air.

JACK & HEINTZ *Rotomotive*

Circle No. 11 on Reader Service Card.

in APU field service!

Designed specifically for auxiliary power application, the G32 Generator has been up-rated from 500 to 750 amps continuous

HIGHER OUTPUT: The G32 delivers 750 amperes continuously—at least 50 per cent more power than similar contemporary machines. This generator has excellent overload characteristics such as required in jet starting application.

SIMPLER, LIGHTER INSTALLATIONS: High power of the G32 permits reducing the number of generators in many APU installations. Simultaneously, the complexity of associated components is simplified with resulting weight savings—a significant factor on air-borne applications.

WIDE FIELD EXPERIENCE: More than 14,000 J&H G32 Generators are in the field today! Their use includes air-borne, shipboard and ground-power installations where 600 to 750-amp, continuous-duty conditions exist. Service records show longer periods between overhauls, reduced maintenance costs.

STARTER-GENERATORS: Two of the J & H Series Generators act in a dual role . . . are supplied with a starter winding which enables the generator to act as a starter for gas turbine engines on many APU's.

COOLING: Both blast-cooled and self-cooled models are available.

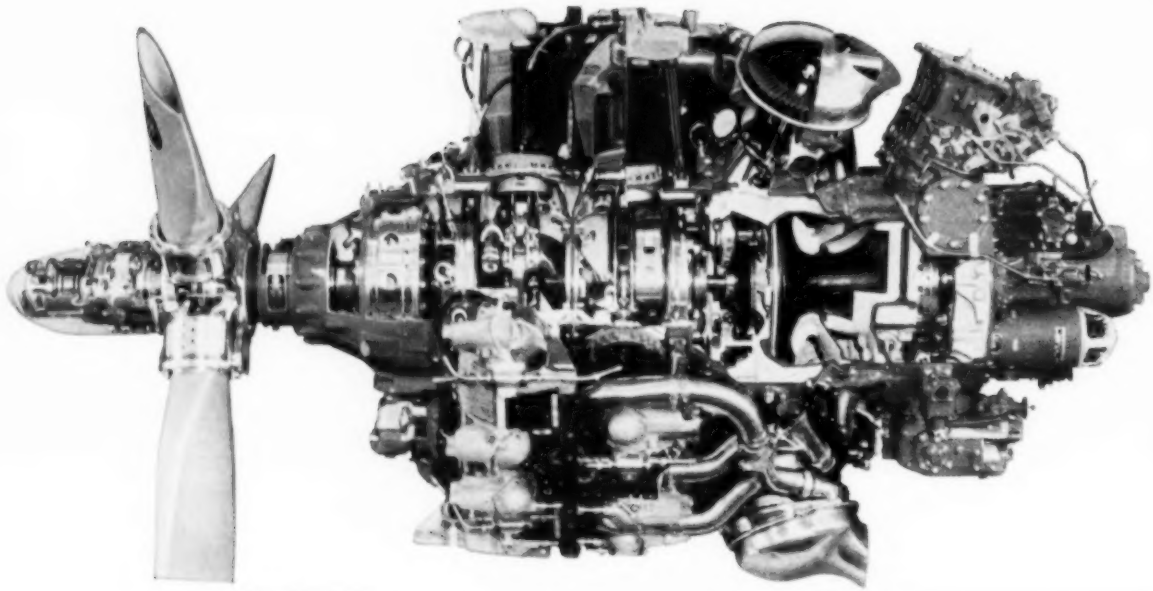
JACK & HEINTZ G32 D-C GENERATORS

(a-c generators also available in ratings through 160 kva)

J & H MODEL NUMBER	G32-3	G32-6 Starter-Generator	G32-8	G32-9	G32-10 Starter-Generator
Continuous-Duty Rating					
Speed (thousand rpm)	4-8	4-8	4-8	4-8	4-8
Voltage	30	30	30	30	30
Amperes	750	750	750	750	750
Intermittent Rating (amp)	1000+	1000+	1000+	1000+	1000+
Cooling Method	Blast cooled	Blast cooled	Self cooled	Blast cooled	Self cooled
CFM of Air at 6" H_2O	300	300	—	300	—
Weight (lb)	78	79	82	78	83
Overhung Moment (in.-lb)	385	406	430	385	450
Over-All Length From Mounting Flange (inches)					
Radial Air Inlet	13	13	—	13	—
Axial Air Inlet	—	14	—	—	—
Self-Cooled	—	—	13	—	13
Diameter (inches)	10	10	10	10	10
Flange-Type Spline AND 10266	XV1H	XV1H	XV1A	XV1H	XV1A
Rotation (viewed from end opposite flange)	CW	CW	CW	CCW	CW

For complete information on J&H G32 d-c Generators for auxiliary power units, write: Jack & Heintz, Inc., 17633 Broadway, Cleveland 1, Ohio. Export Department: 13 East 40th Street, New York 16, New York.

© 1956 by Jack & Heintz, Inc

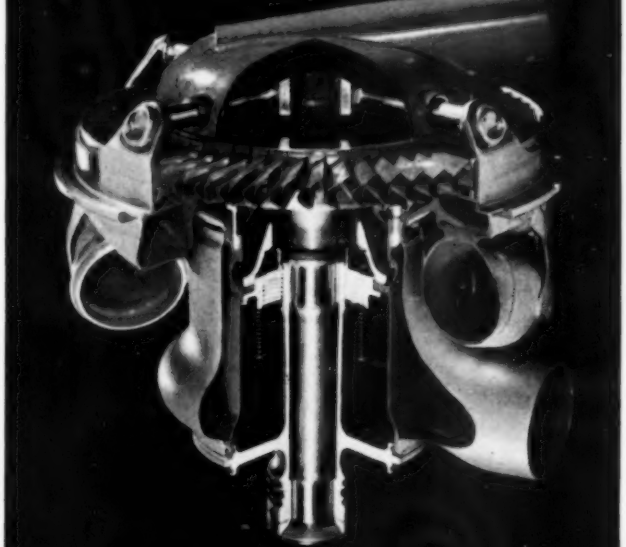


CURTISS-WRIGHT
Turbo Compound Engines are in use by 30 World Airlines plus leading military aircraft

Kelsey-Hayes helps put 20% power bonus into Curtiss-Wright engines

One more example of Kelsey-Hayes diversity at work for major industries throughout America

Any way you translate it—*20% longer range, 20% less fuel, 20% more payload*—power recovery turbines on the Curtiss-Wright Turbo Compound engine mean greater operating economy. The entire power recovery unit — requiring 2000 close tolerance machining operations — is manufactured to highest engineering standards by the Aviation Division of Kelsey-Hayes.



CROSS SECTION of the velocity-type, power recovery turbine unit manufactured for Curtiss-Wright by Kelsey-Hayes. The unit consumes no fuel. Exhaust gases are piped directly to the turbine and converted to usable power. There is no harmful back pressure. Effective operation is assured at all speeds and altitudes.

KELSEY-HAYES

Kelsey-Hayes Wheel Co., Detroit 32, Mich. • Major Supplier to the Automotive, Aviation and Agricultural Industries

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Circle No. 12 on Reader Service Card

(*Continued from page* 34)

most likely will have to be expanded to service this newer type aircraft. Ground-handling facilities involving reservations procedures, city ticket offices and, more directly, arrangements at the airport are all due for major revisions and extensions.

It was previously indicated here (AMERICAN AVIATION, December 7, 1955, page 27) that the U.S. industry's capital outlays for aircraft and related equipment during the next ten years may reach as high as $3 billion. It now appears these expenditures may go beyond that amount.

Yet at last reports (September 30, 1955), the entire U.S. air transport industry—domestic, international, cargo—had total assets of but $1.3 billion. Net worth of this group stood at but $660 million with long-term debt at $230.7 million. It is obvious that the capital requirements for the industry dwarf the size of its present resources.

• **A substantial part** of the estimated $3 billion in new capital expenditures will be forthcoming from retained earnings, internal sources such as depreciation cash throw-offs plus the proceeds realized from the sale of surplus aircraft.

The balance of funds required will be new money in the form of debt—both long-term and short-term, plus equity-type securities and in the aggregate may be of the order of $1 billion to $1.5 billion. The exact amount, of course, being dependent upon the measure of earnings and cash generated from the other sources enumerated.

Experience Not Always Guide

Greater perspective can be obtained by looking at the individual airlines separately. It is a fact of life that no one company can live by the average experiences of its industry.

• **The accompanying table** reveals the key elements of the financial position of the separate U.S. airlines as of September 30, 1955. The local service airlines are also included.

Although ignored in the general jet headlines, these smaller carriers have major equipment transition problems of their own. Their perennial search for a DC-3 replacement may soon appear in such planes as the Fokker F-27 as well as in the Martin 2-0-2 and Convair 240. These transitions will bring on financing requirements.

It is significant that a large incidence of debt exists for most of the carriers. Debt ratios of anywhere from 20% to 30% for the trunk carriers is not uncommon. The local service carriers have debt ratios at a much higher level. Yet, the Civil Aeronautics Board in a pronouncement issued in a mail rate case in June 1952 asserted that:

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PUSH-BUTTON SWITCHES

. . . designed to MIL-S-6743 specifications for aviation's toughest jobs.

- **Fully moistureproof**
- **Positive snap-action cannot be teased off contact**
- **Withstands 20G vibration up to 2,000 cps.**
- **Made in six single-pole circuit arrangements**
- **Choice of 7 mounting adapters (illustrated)**
- **Rated for 25,000 operations at 10 amps, 28 volts dc.**

Detailed specifications on the complete line of Hetherington precision push-button switches designed to MIL-S-6743, drawing MS-25089 will gladly be sent on request.

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1200 ELMWOOD AVENUE • SHARON HILL, PA.

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HETHERINGTON
Snap-Action Switches

SNAP-ACTION SWITCHES FOR ALL AIRCRAFT AND PRECISION INDUSTRIAL APPLICATIONS • INDICATOR LIGHTS • SWITCHES WITH BUILT-IN LIGHTS • HIGH-IMPACT RELAYS • COILS • SOLENOIDS.

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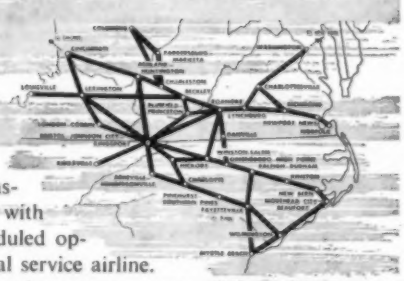
Every passenger flying Piedmont Airlines along its 3,290-mile "Route of the Pacemakers" is a VIP. More of these "very important passengers" — 1,605,665 — have flown more passenger miles — 338,425,658 — with Piedmont in eight years of scheduled operations than with any other local service airline.



Frequent, dependable flights and courteous personal service have helped Piedmont establish many such industry records.

Of equal importance has been a fine working relationship with all segments of the air transportation industry. Since much of Piedmont's passenger business has been "interline", the industry's contribution to our progress has been great. We appreciate the splendid cooperation given us in the past by our airline friends and know we can count on the same in the future.

In the 50 cities Piedmont serves in seven states and the District of Columbia, we pledge to continue doing all possible to develop and stimulate more and more interline air travel.

PIEDMONT Airlines

Home Office and Operations Base — Smith Reynolds Airport

WINSTON-SALEM, NORTH CAROLINA

"We are convinced that primary reliance on equity capital rather than debt is desirable for both local service and trunk carriers. Transportation as a whole, and air transportation in particular, as we have seen in the not too distant past, is subject to sharp contractions during the recession phase of the business cycle. During such periods, a capital structure which includes extensive reliance on debt, with its fixed obligations that must be met when due, inevitably places the carrier in jeopardy of bankruptcy. Such risks are substantially reduced when the carrier is soundly financed with equity securities; for equity capital, with its freedom from fixed charges, will act as a cushion against economic adversity."

Were this admonition to be pursued by the industry, it would have been hard-pressed to have financed its past expansion to say nothing of undertaking its new commitments.

• Much is made of the improved credit position of the airline industry because of its ability to attract hard-boiled insurance money on long-term debt. Thus far, however, only a handful of airlines have been so favored with such fiduciary credits and only because they have been able to meet certain basic requirements. A good management reputation with a satisfactory earnings record is not always enough. An adequate equity base must also be present to support the debt structure. Industry competitive trends and future cash generation through depreciation charges are among other factors to be considered.

Thus far in this recent cycle, only three major airlines have arranged long-term debt with insurance companies. It is indeed an accolade of high credit standing for all of these carriers to have obtained these credits on a generally favorable basis. But even within these three loans, there are fine distinctions which reflect upon the individual carriers' credit—and negotiating abilities.

Eastern's Rate Lowest

• Eastern's 20-year $90 million credit, all with Equitable Life, has the lowest interest rate, 3¾%. It also has a novel twist. A total of $50 million was taken down around Dec. 15, 1955 and is subject to a flat 3¾% rate. The balance can be taken down at any time prior to Dec. 16, 1959.

The interest rate on the remaining $40 million is keyed to the credit of the U.S. Government, i.e. ¼ of 1% above the yield of the 3% U.S. Treasury Bonds of 1995. This rate cannot be less than 3¾% or higher than 4¼%. If Eastern had any portion of this loan outstanding under this provision, its effective rate would be, at present, well within the minimum of 3¾%.

United Air Lines arranged a $120-

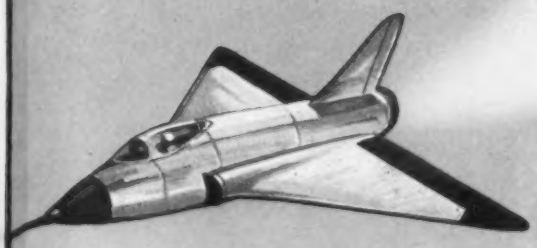
Bendix Products Division

A DEPENDABLE SOURCE

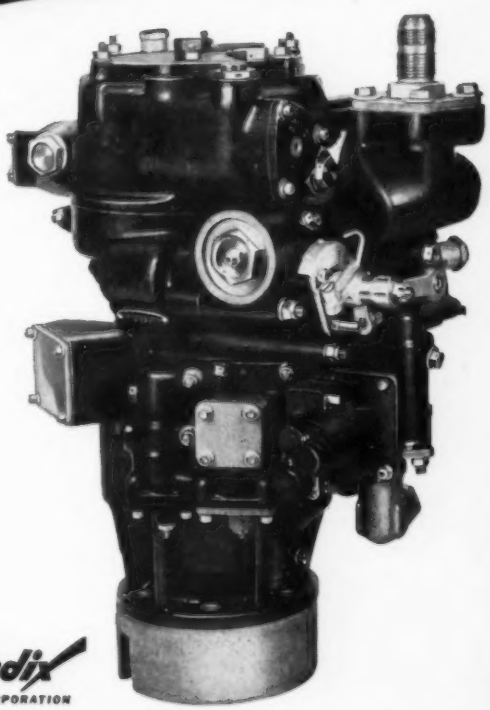
FOR CREATIVE ENGINEERING AND QUALITY MANUFACTURING

BENDIX Products Division has long specialized in FUEL METERING, ENGINE CONTROL SYSTEMS and LANDING GEAR.

SERVING ALMOST ALL American airframe and engine manufacturers, Bendix can bring much of the COMBINED KNOW-HOW OF THE INDUSTRY to the benefit of any one project.



FOR EXAMPLE...



This advanced type fuel metering unit was developed by Bendix to include special features for the 10,000-pound thrust class Pratt & Whitney J-57 turbojet—the engine which puts the power behind the super performance of the F4D Skyray.

As early as 1945, Bendix brought out a jet engine control which automatically metered fuel during engine acceleration and deceleration so as to avoid over-temperature, compressor stall and "flame out". Since then, these features have become a "must" on all jet engine controls, allowing the pilot to slam the throttle wide open without danger of ruining the engine, or slam it shut without risk of "flame out".

Bendix fuel metering is used today on nearly all American airliners, and on a great majority of military aircraft. This includes injection type carburetors and direct fuel injection, as well as fuel metering and complete engine control systems for jets.

These and other achievements are solid evidence that the aircraft industry can continue, as in the past, to look to Bendix for creative engineering and quality manufacturing.

Float and injection type carburetors . . . Direct injection fuel systems . . . Fuel metering and engine control systems for jets and turboprop engines . . . Brakes, wheels and shock absorbing struts for all types of airplanes.

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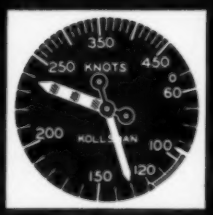
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

A. Gives altitude fully corrected with realistic overall errors under 50 feet at sea level and 100 feet at 40,000 feet. Needs *no* standby unit.

B. Maximum and minimum safe speeds shown on the familiar "indicated airspeed" dial, and maximum L/D for cruise controls.



C. *Corrected* Mach Number is indicated on the Machmeter Dial.

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D. *True* airspeed is indicated on a miniature digital counter. *No* computing needed.

E. *True* outside air temperature, read directly on a dial *corrected* for speed. Facilitates jet stream flying.

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the greatest advance in flight instrumentation since the first air transport took to the air lanes

A NEW INTEGRATED MODULAR FLIGHT INSTRUMENT SYSTEM FOR TURBINE POWERED TRANSPORTS

1. VASTLY INCREASED ACCURACY

2. IMPROVED READABILITY **3. PRESENTS CORRECTED DATA — NO COMPUTING NEEDED**

4. WITH TESTED DEPENDABILITY

The higher operating ceilings and high performance of the new Turbine Powered Transports pose new problems for pilots and Airways Traffic Control.

To simplify the pilots task and achieve better flight level control, improved flight aids are required. The Kollsman answer to this problem is the Integrated Modular Flight Instrument System.

Altitude Data — With Tested Dependability This system provides improved accuracy of altitude information. To accomplish this and still retain the high dependability of the present day Kollsman Altimeters, a mechanically operated Drum type Altimeter is used as the basic instrument. The mechanism error is removed electromechanically using a special adjustable correcting cam. Then the installation error is corrected with a fixed cam as a function of Mach Number and, if required, of Angle of Attack for pilots, co-pilots, and alternate static systems. Total altitude error through this means can be held below 50 feet at sea level and 100 feet at 40,000 feet.

Maximum and Minimum Safe Speeds Shown At All Times The system further simplifies the pilot's task by providing maximum airspeed information throughout the entire operating range of the aircraft, maximum L/D for cruise control, and minimum speed for safe low-speed landings through proportional Angle of Attack approach indication, logically displayed on the familiar IAS instrument.

Corrected Mach Number The system provides for corrected Mach Number on the separate Machmeter dial.

True Airspeed Indicated True airspeed is provided for the pilot or navigator on a miniature digital type instrument, provided with a synchro transmitter for additional remote indicators. This simplifies the problem of navigation by eliminating the need for computing true airspeed.

True Outside Air Temperature Read Directly The system provides true outside air temperature accurately corrected for speed, and incorporating a synchro transmitter for additional remote indicators. This information makes Jet Stream flying more easily accomplished by providing a simple means of detection of the sought after currents.

Ram Air Temperature For efficient jet engine performance accurate Ram Air Temperature is provided on a separate indicator.

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(*Continued from page* 40)

million 25-year credit at 4% with three insurance companies: Metropolitan, Prudential and Mutual. Significantly, the United credit, aside from being the largest, clearly has less restrictions and more flexibility than any of the other airline loans negotiated.

It is also interesting to note that it follows the basic formula outlined in the indenture covering the company's first insurance loan of $12 million, arranged with the Metropolitan and Mutual in February, 1947.

Moreover, United also has arranged a credit of $30 million with 38 banks and available through Dec. 31, 1960. The rate in this instance is specified at ¼% above the prime rate, which would currently make it 3¾% if any of this credit were drawn down. United will thus have $150 million available through these credits and appears to have fully anticipated its future capital requirements.

• **American Airlines** arranged a $75-million credit at 4% with the Metropolitan Life Insurance Co. Although having a stated maturity of 40 years, a provision permits the airline *or* the insurance company to call the loan at Nov. 1, 1986, which if accomplished would make this a 30-year credit.

All three airline credits with the insurance companies have the same provision specifying repayment starting at least ten years from the date of issuance of any notes. This delay in repayment schedules will permit the carriers to have the benefit of earning power generated by the new equipment in the interim.

Moreover, should there be any delay in delivery schedules of the jets, the airlines will not be crowded by any repayment maturities.

Not all airlines propose to tap the insurance company reservoirs for capital. For example, National Airlines is proceeding with a $112-million equipment expansion program which it plans to finance with a $36-million bank loan. The balance of funds are expected to be generated from retained earnings, depreciation accruals and the sale of surplus aircraft.

An examination of the supporting table leads to the surmise that as equipment delivery schedules approach, many of the other airlines may be forced to seek additional capital through the sale of equity-type securities. With stronger equity positions, additional debt may then be attracted. ◆◆◆

More Planes and Capacity to Be Added To U.S. Civil Reserve Air Fleet

The Civil Reserve Air Fleet program is about to be changed again so that the military services will have an increase in available ton-miles of more than one-third on M-Day.

Under the existing set-up, the nation's scheduled and irregular carriers have agreed to provide 317 four-engine transports (plus 25 more in a contingency reserve to take care of crashes, etc.) for immediate assignment to the Military Air Transport Service in case of emergency.

But various government agencies are now getting ready to approve a proposal to:

• Increase the number of transports in CRAF slightly.

• Boost by more than one-third the available capacity of 5.67 million ton-miles on a 10-hour day in commercial operations.

• Provide a peak-and-valley arrangement so that MATS would return some of the planes to the carriers if the military requirements lessen.

Planes contributed to the CRAF program come from two basic sources:

• All the suitable four-engine (over-ocean capable) transports of the non-skeds.

• A fixed (and approximately equal) percentage of the total airlift capacity of the scheduled carriers—including the twin and four-engine airliners they operate.

• It is estimated that conversion of these commercial transports to make them suitable for military use, i.e., installation of electronic "black boxes," is about 80% complete for the 317 planes in the present program. With the forthcoming increase, the percentage figure will drop. But it is also true that a considerable number of transport aircraft recently delivered to the nation's air carriers—planes which are not officially in the CRAF program—were fitted with the necessary electronic equipment at USAF expense when they were moving down the production lines.

• **The Commerce Department's** Defense Air Transportation Administration, which is the prime mover is coordinating the transports assigned to CRAF, also performs a related function—recommending to the Office of Defense Mobilization the transports which may be amortized in five years for tax

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FOR AIRCRAFT TIRES
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PRECISION Treading By the Exclusive Hawkinson Method
Authorized HAWKINSON TREAD Service
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MORE OF THESE INSURANCE COUNTERS THAN ALL OTHERS COMBINED . . !

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AND MORE OF THESE FAMILIAR BLUE ASSOCIATED AVIATION MACHINES THAN ALL OTHERS COMBINED!

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Norman P. Rose
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Meet the "Operating Directors"

These men and women – the "operating directors" and department heads of Western Airlines–have a combined total of 370 years of airline experience. Each is a recognized expert in one important phase of modern airline management. They share the conviction that "nothing is too much trouble" if it helps to make Western's service the finest in America. Their enthusiasm and skill have brought Western–now celebrating its 30th birthday–to a new high in operational efficiency, and have pioneered new advances in public service by air.

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# of America's Senior Airline

Rain or Freeze, Hy Trol Always Helps

As Hy Trol will tell you, a hot number can be pretty hard to handle under wet conditions. And if you think we're talking about landing fast airplanes, strangely enough, we are.

Hy Trol once assisted in C.A.A. supervised tests involving landings on icy runways. With Hy Trol's help, the pilot brought the heavy plane to a stop within 50 feet of the required distance for dry runway conditions. Smooth and straight, too; right down the groove. Rain, snow or ice, Hy Trol gives maximum control after touchdown.

When the birds are crawling, you'll be glad you've got Hy Trol along.

hytrol is Standard Equipment on: B-47, B-52, A3D, RB-66, RF-84F, F-100, C-130, QF-80 Installed on DC-4, DC-6, DC-7, DC-7B, C-46, C-54, C-97, C-118A, C-130, B-377, R5D, R6D, P2V-5, Avro Jetliner, F9F, F-80, F-84F, F-89, F-94, F-101A, B-36G, YB-60

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the *accepted* Anti-skid Braking System

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HOT AIR VALVES • FUEL VALVES
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BURBANK, CALIFORNIA • *Aviation Subsidiary of* CRANE CO.

purposes because they support the defense program.

ODM's goal of 900 planes eligible for certificates of necessity has been filled but DATA is now urging that the expansion goal be reopened on an open-end basis.

To date, DATA has recommended and ODM has approved five-year tax write-off certificates on more than $1,058,925,000 worth of air transports and spares.

Number of planes thus certified is 726. (ODM's 900-plane goal is calculated on produced aircraft rather than on certificates applied for. In other words, there are 174 transports in the ODM goal for which certificates of necessity have not been sought.) This is the breakdown:

Carrier	Planes Approved
American	39 DC-7s
	37 DC-6Bs
	35 Electras
	7 DC-6As
	5 Convair 240s
Aviation Equip. Corp. for Seaboard & Western	3 L-1049Bs
Braniff	25 Convair 340s
	7 DC-7Cs
	3 DC-6s
Capital	60 Viscounts
	12 L-049s
Chicago & Southern (merged with Delta)	10 Convair 340s
	5 L-649s
	1 L-749
Continental	7 Convair 340s
	3 DC-6Bs
Delta	21 DC-7s
	20 Convair 340s
	1 DC-6
Eastern	60 Martin 4-0-4s
	40 L-1049s
	37 Electras
	20 DC-7Bs
	12 DC-7s
Flying Tigers	7 DC-6As
National	12 Convair 340s
	8 DC-6Bs
	4 DC-6s
	4 DC-7s
Northwest	12 DC-6Bs
	8 DC-7Cs
	6 L-1049Es
	1 DC-6A
Seaboard & Western	1 L-1049B
TWA	40 Martin 4-0-4s
	26 L-749s
	20 L-1049Es
	10 L-1049s
United	46 DC-7s
	27 DC-6Bs
	5 DC-6As
Western	21 DC-6Bs

New plant now filling big demand for Teflon® hose

THIS newly opened Resistoflex plant is now producing Fluoroflex®-T hose and assemblies at a greatly increased rate. Ample, efficiently planned space, enlarged production facilities, added equipment . . . these make it possible to turn out record quantities of the finest quality aircraft hose ever developed.

Fluoroflex-T hose is the *original* Teflon hose. It's the only Teflon hose proved by over 3 years' flying service, and is now universally specified for vital applications.

This hose has approval of the Services and CAA for synthetic oils, fuels and nitric acid . . . and is applicable for ambient temperatures up to 500°F. Bulletin FH-2 tells more. Send for it.

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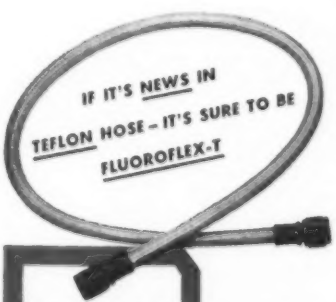

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Civil and Military Agencies Burying Differences To Solve Air Traffic Control Problem

By LOIS C. PHILMUS

Aviation's No. 1 problem—airway and air traffic control—has taken a turn for the better in 1956, following a peak year of debate in 1955. The crescendo of arguments, accusations and presentation of extremes which characterized the year past has apparently changed its tone.

While the many facets of the problem are far from solved, the heavy pressures exerted in 1955 by users of the airspace have jarred those elements charged with developing and operating a workable system into at least facing in the same direction.

As the smoke settles, a pattern has emerged, and it is encouraging:

• **Civil Aeronautics Administration**—charged with operating the system for both civil and military aircraft—has been blasted out of its lethargy of reciprocating-engine thinking into planning for the jet age.

Under guidance and approval of the Air Coordinating Committee, a five-year plan has been developed which has the backing of industry and the military. To kick it off to a healthy start, CAA is asking Congress to appropriate $40 million for establishment of new facilities and a record $111 million for operation.

Organizationally, a new concept is being implemented under leadership of the new CAA Administrator, Charles J. (Chuck) Lowen, with the establishment of an Office of Air Traffic Control. It will reverse the highly criticized philosophy of Fred B. Lee, Lowen's predecessor, which had the operations of the control system governed by the tools provided by the engineers. Under Lowen's program, the controllers will provide broad performance specifications for the equipment they need to the engineers in the Office of Federal Airways. Specifically, it will reverse the past practice of developing "black boxes" and then figuring out operational uses.

Heart of Plan

Heart of the five-year plan is radar and peripheral communications. Objective is to provide facilities for positive control at altitudes above 15,000 feet by 1965, through the communication and navigation system. Here's how it looks:

• **Between 70 and 85** long-range radars are needed for complete U.S. coverage. Program calls for authority to provide coverage in fiscal 1957 for Norfolk-Chicago-Boston; Chicago-St. Louis-Kansas City; Atlanta-Jacksonville-New Orleans; Dallas-Fort Worth-San Antonio; Denver; San Diego-San Francisco and Seattle-Portland.

An intensive Air Defense Command-CAA survey is under way to determine how many ADC radars can be used in this plan. The military radar installations have been sited for defense purposes rather than traffic control. It must be acknowledged that the problems are many. Those radars not sited properly must be scrutinized for possible moves without interfering with primary purpose. Then there is the possibility of remoting to control sites, which can cost as much as a new installation. At best, it is a mammoth project that must be accelerated. The President's Budget Message calls for the installation of 69 long-range radars by 1961, 18 of them in 1957.

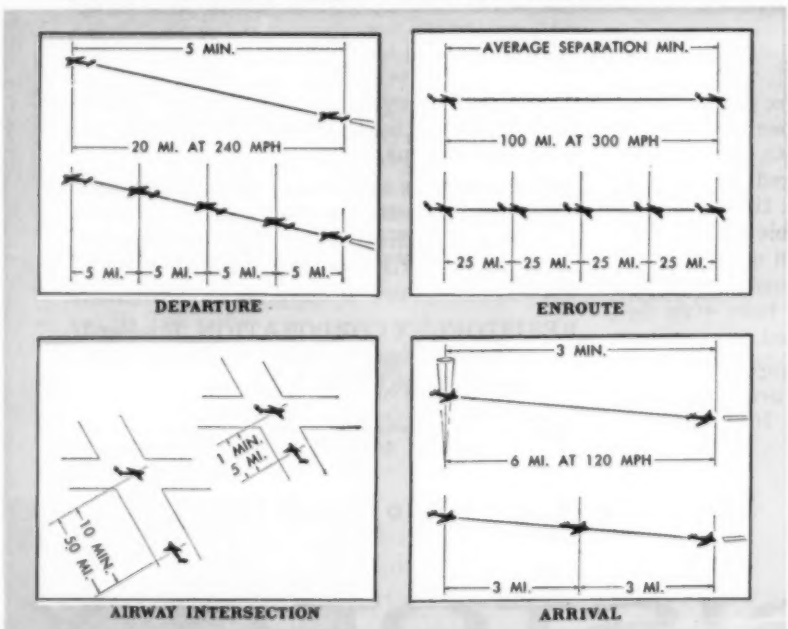
• **Funds are being asked** to provide peripheral communications at all CAA Air Traffic Control Centers to be fully operational by fiscal 1959. This will provide the sorely needed direct pilot-controller communication contact at all IFR altitudes on the airways.

• Expansion of the navigation system calls for 383 additional omniranges and a critical need to end the TACAN-VOR/DME battle. No matter what the outcome, azimuth and distance must be measured and there is every indication that a Civil Air Regulation to that effect will be in existence by 1965.

If Congress approved the funds and the program—and in view of the highly critical attitude of some Congressmen toward the Department of Commerce, it will be hard-pressed to refuse the request—CAA estimates its peripheral communication plan can be operational within three fiscal years; its navigation system and radar coverage within six years.

• **To sum up,** CAA officials feel they can "revolutionize" airways and air traffic control with all aircraft equipped with Rho-Theta navigation equipment coupled with a computer; plus complete radar coverage and peripheral communications. In addition, ground-to-ground data link between INSACS, Centers and Control Towers will speed up the processes. With this plan, CAA feels it can handle anticipated traffic up to present capacity of airports.

Within these program outlines, CAA's Technical Development Center has been busily engaged in in-service improvements to present aids: A program to improve the accuracy of VOR has been launched with conversion of antennas to the newly developed stacked-array design. Minimums in ILS prob-



HOW AIRSPACE SAVINGS can be effected by radar coverage over manual separation is shown in these four diagrams.

lem sites are expected to be brought down considerably with the replacement slotted antenna designs.

• But this is just part of the solution. No matter how much airway and air traffic control is speeded up, the present rate of acceptance of runways at civil airports will slow it down. There is a critical need for a gigantic renovation in this area. Partial solutions can be found in installation of parallel runways; dual direction approaches and high-speed taxi turnoffs. But at this writing no integrated plan is in effect.

Antiquated Communications

Antiquated communications are coming under blistering attack. Col. J. Francis Taylor, director of the Air Navigation Development Board, labels this the most serious problem, blaming "lack of engineering effort." Some form of data link between the cockpit and the ground must quickly be developed.

With an anticipated 1,100,000 instrument approaches predicted for 1965 —nearly double 1955's 632,806—voice communication between controllers and pilots will not be the answer.

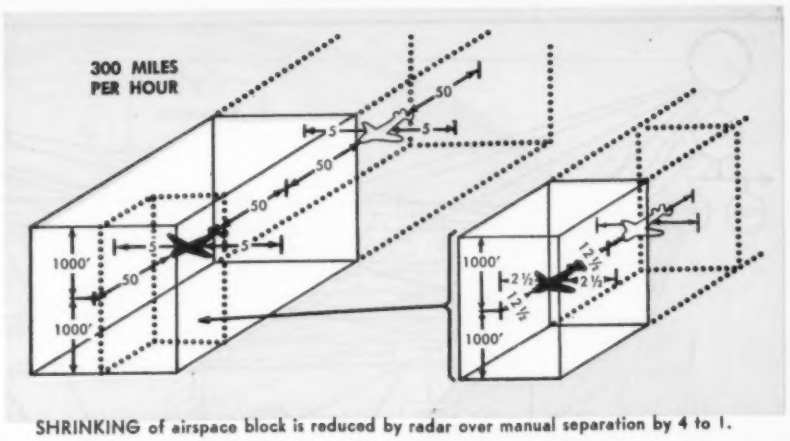
Air Transport Association is expected to come forth shortly with a proposal to the ANDB to be cleared through ACC that would provide automatic communications with existing equipment. CAA does not expect to be able to write a specification for an air-ground data link before 1961—ATA, ANDB and others feel it can come sooner.

That brings up the serious situation of the lack of system planning. The creation of the post of Special Presidential Assistant for Aviation Facilities Planning, to which Edward P. Curtis has been named by President Eisenhower, gives hope that the situation will be cleared up. While the interim control situation is being patched up as efficiently as possible, a long-range plan is vital.

Harding Recommendations

The Harding Committee, in its report to the Bureau of the Budget, concluded: "The multimillion-dollar leviathans of the air which our aircraft manufacturing industry is creating in the jet age must become integral parts of a transportation system which includes the airport complex (with adequate approach areas), the airway (with its traffic control, navigation and instrument landing devices), and the associated communications on the ground and in the air."

After intensive study, the committee found that "a piecemeal rather than a system approach" was responsible for the present situation, with a labyrinth of committees, subcommittees and working groups—all overlapping, bogged down and lacking direction.



SHRINKING of airspace block is reduced by radar over manual separation by 4 to 1.

It got to the heart of the situation when it warned that "unless some urgent action . . . is taken to provide full time high-level leadership to the problem of bringing . . . aviation facilities in line with air traffic growth and the progress being made in aircraft development, ever more dangerous conditions in the air can be anticipated."

President Eisenhower took the warning and responded with the immediate appointment of Curtis, who is charged with: (1) direction and coordination of a long range study of aviation facilities requirements; (2) development of a master plan for meeting the needs set forth in the requirements study; and (3) most important of all, formation of legislative, organization, administrative and budgetary recommendations to implement the plan.

This, probably more than any other action, has spurred the rush of patch-up activity which although vital, does not get at the heart of the problem. As the smoke settles around the conflagration, it is apparent that the lack of coordination and overall leadership has brought matters to the critical situation faced today. Here are the causes and effects that brought about Curtis' appointment:

• While in broad requirement principles, airlines, military and civil aircraft users have been in agreement, the ways and means of accomplishing the principles have split them into enemy camps. A true working spirit of compromise and cooperation has been lacking. Each has individual missions and objectives. While vocally expressing mutual desire to make the Common System workable, the many different elements have been pulling in different directions.

• Lack of a central authority obviously is at "the root of the evil." Civil Aeronautics Administration, intended to be the operating agency, has had neither the leadership nor the clear-cut legal authority to act decisively. The Air Force, Navy, Army and overall Department of Defense, while participating in the labyrinth of committees, subcommittees and working group, still maintain within each service duplicating, overlapping and separate departments to accomplish the same aims.

• Air Coordinating Committee established to coordinate policy has failed to a large degree. Reason: The same representatives of the participating services which have individual policies are represented on the committee to establish one *compromise* policy. Deadlocks, undue delays and lack of coordination have been the result. Again, lack of one central, *neutral* authority has canceled out progress.

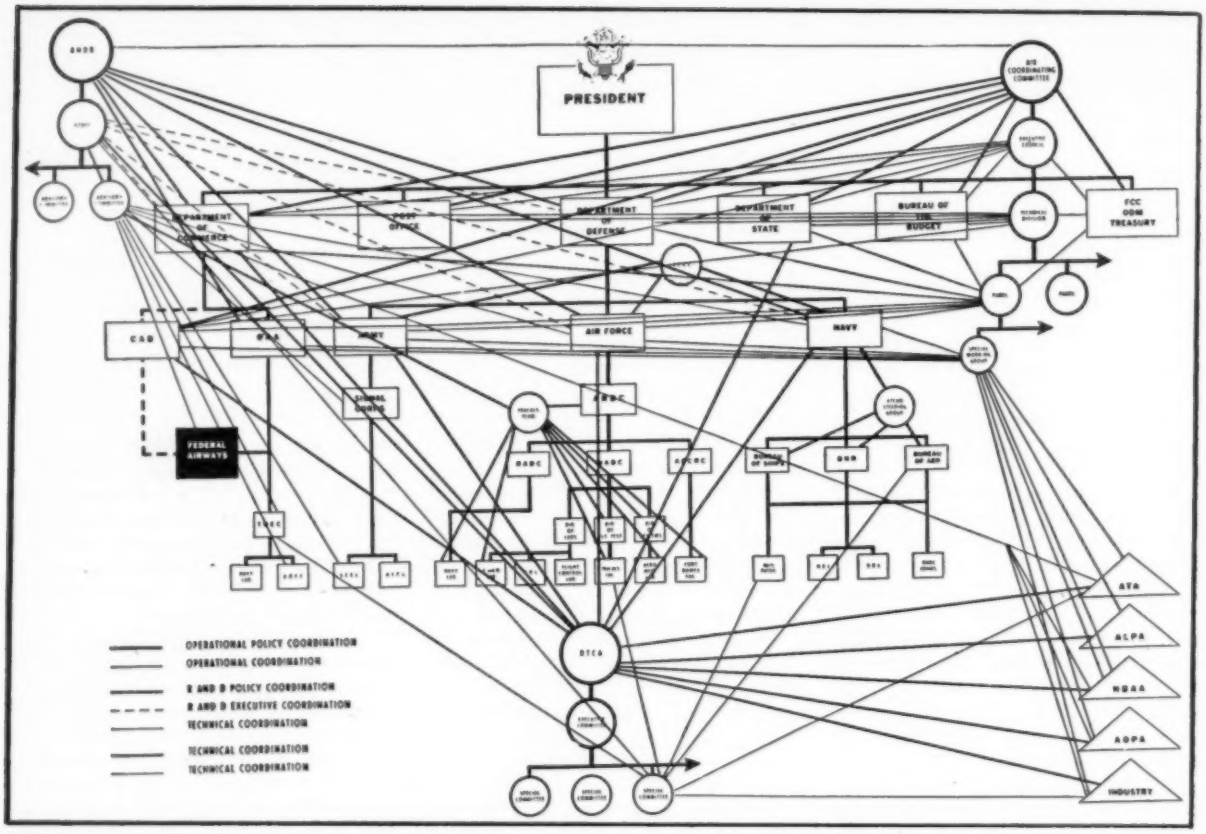
• Air Navigation Development Board, established to coordinate interagency development programs, has been handicapped by a duplicate situation with greater emphasis. Its five participating agencies create a four-to-one advantage for the military services, while ACC gets stalemated because of its many co-equal representatives. As a Senator facetiously put it: "Everyone is in ACC except the Department of Welfare and Education."

• Compounding the confusion, none of the agencies or interagency groups have clearcut authority for any of their functions. The complexities further increase as industry association advisory groups contribute more viewpoints and methods of achieving the objective—which unfortunately has gotten lost in the maze of coordination attempts—A Common System.

Charges and Counter-Charges

From this obviously unworkable base have come cries of indignation, accusations of inaction and declarations of fear from the users of the fast-diminishing airspace. Fingers have been pointed at CAA. CAA has accused the military. The military has chastised CAA. The airlines have demanded action.

Not being able to work together ef-



COMPLEXITIES of governmental structure for navigation and air traffic control are graphically illustrated in organizational chart that shows research and development structure and coordinating organizations.

fectively, all have been working apart. Long-range planning has never been undertaken. Interim planning has not been in any better shape. Actually no one group is to blame, nor blameless. If anything, the President's Air Policy has failed in this way: While directing the establishment of a single common civil military system of air navigation and air traffic control, it did not provide the proper executive machinery to develop and operate it.

Budgetary considerations have certainly been a contributing factor, but are an effect rather than a cause. CAA in fiscal 1956 had its budget request for establishment of airway facilities slashed by Congress from $23 million to $16 million. Weakness in programming the funds was the prime reason for the cutback.

Specifically, the "catch-as-catch-can" organizational set-up of the Federal government has wrought the following:

• TACAN vs. VOR/DME is probably the most outstanding example of the complete lack of coordination in the development of Common System aids. While CAA was placidly implementing an agreed-to system, the Navy, under heavy cloak of security, was developing TACAN. Both systems measure azimuth and distance but are completely incompatible.

The result? With the VOR program virtually completed and the DME program half-way implemented TACAN is brought into the open. Air Force joined the Navy in demanding TACAN be implemented as the Common system; CAA demurred with the strong support of general aviation. Hundreds of millions of dollars are involved in the TACAN development; lesser sums in the development and implementation of the civil system.

Violent Controversy

Washington for the past 18 months has been the battlefield for one of the most violent controversies in aviation history. Any compromise at this point will be costly and time-consuming. Chances of a sound compromise are nil. No matter what solution is offered, it will be a political and economic one—not a technical one.

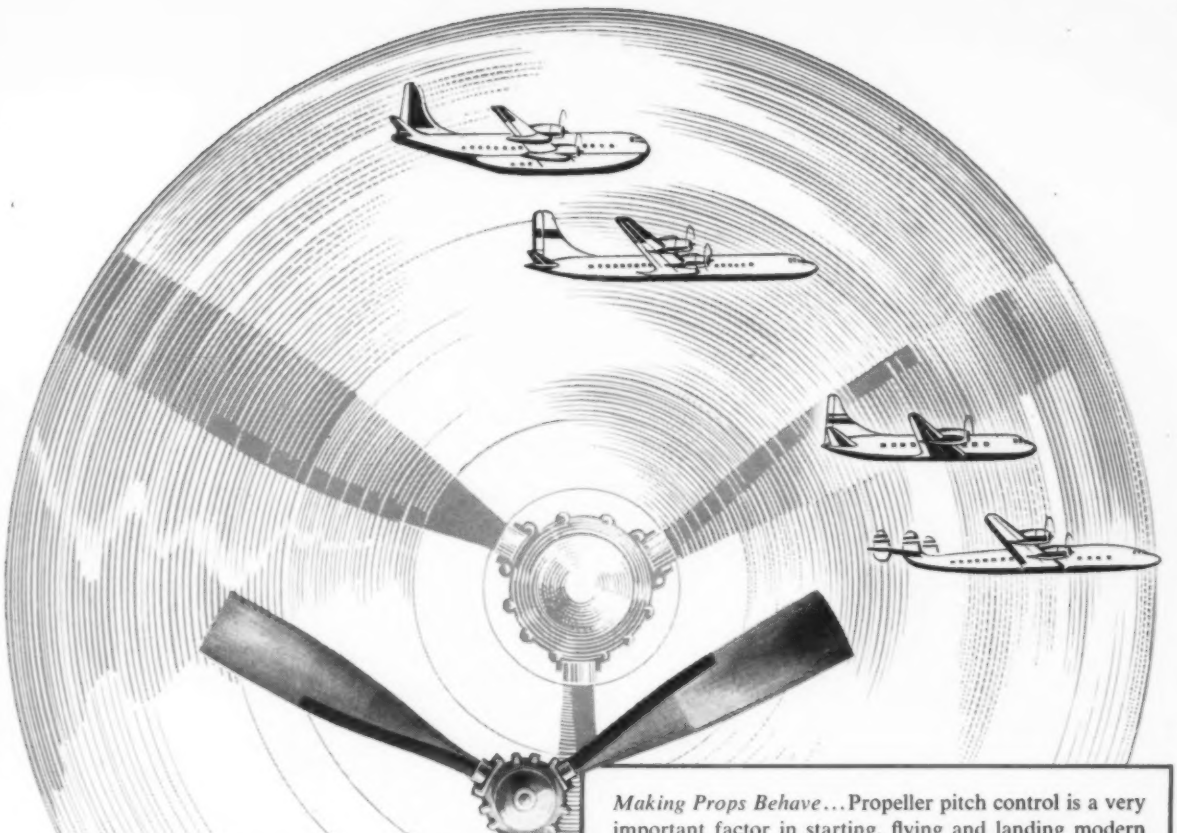
There is a growing need among all of aviation to measure distance. This will be delayed—because even if civil DME is continued, military proceeding with TACAN can only spell uncertainty on the future of either. The establishment of a short-range navigation system is at a virtual standstill.

• Safety beacon shows all the signs of duplicating the short-range navigation system fracas if coordinated action is not taken soon. The safety or radar beacon's primary function is identification. Col. J. Francis Taylor, director of ANDB, expressed the first pessimism over the current beacon development at a Washington meeting when he said he was only "80%" certain of it at this point. Later, he told AMERICAN AVIATION that the development is hampered by "lack of military operational doctrine."

Disappointment was voiced to this reporter by officials at CAA Technical Development Center in Indianapolis, where the secondary radar is under evaluation. Suitable performance in congested areas is in serious doubt. Excessive "fruit" comes up on the interrogators scope because of kickbacks from other interrogators in the area.

Again the military has thrown the wrap of security around a common system development. It has been learned reliably that the problem is being created by the necessity of making the system compatible with the military's highly secret "IFF" (Identification Friend or Foe) project, which in itself is not perfected.

A highly competent source has pointed out that if a standard were developed for a *common* system beacon, progress could be made. It could be put in the more desirable 2,700 to 2,900



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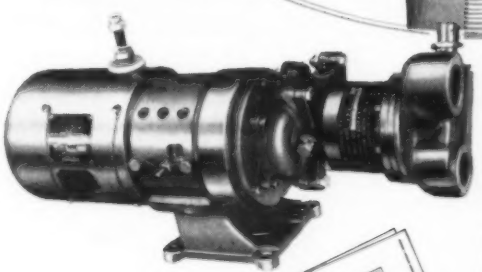

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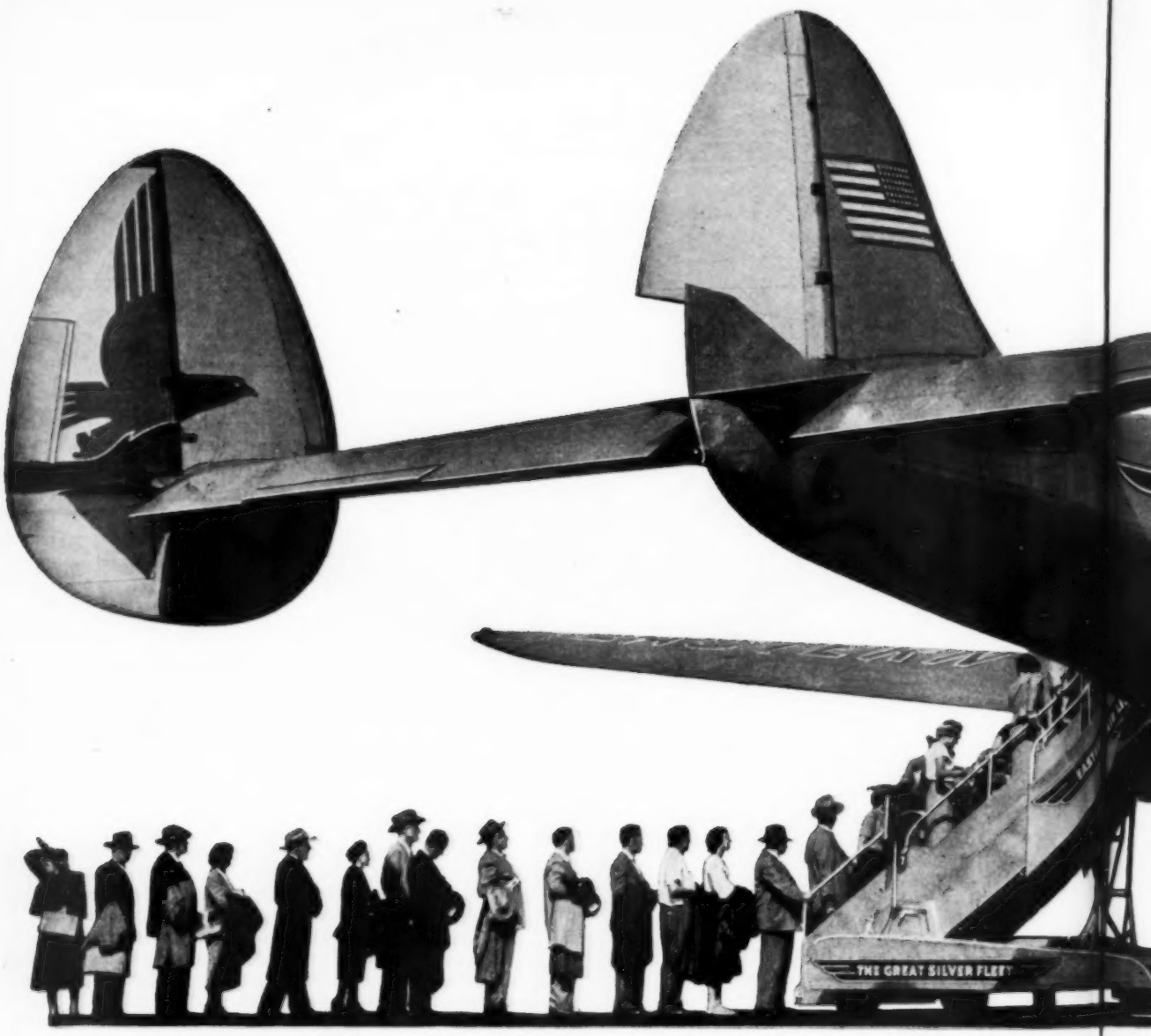

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meg. band and the antenna could be mounted along with the primary radar antenna, a supposedly more desirable arrangement.

The beacon, it is agreed, can be a highly desirable aid—in theory. In addition to its necessary function of identification for the controller, which would eliminate present practice of executing maneuvers to pick out the aircraft on the controller's scope, it could go a long way toward providing longer radar ranges and overcoming weather.

Again, a functioning system of coordination between the services—where all would have been in on development from the start—could have countered what now appears to be a completely unresolved problem.

• ATA says the elements of a completely automatic system are now available, and that about $1 billion and three years of development could create the system. CAA contends the "state of the electronic art" has not yet advanced to make this possible.

The Facts on SAGE

• SAGE (semi-auto ground environment system) has been uppermost in all thoughts. Confusion reigns here too.

One CAA official told AMERICAN AVIATION it was an "unsophisticated view" that SAGE, designed for interception, could be adapted to air traffic control for many years to come. Estimates for its use range from within five years to over 40 years. With the billions of dollars being spent on the project, SAGE must come under organized scrutiny.

The best facts available are these: The prototype is not yet completed at Cambridge. It is an unknown quantity until it is fully developed. Because of its military mission, at this time, it appears obvious that it must be kept for military use at its inception. One very high government official privately declared: SAGE is the far future. Confusion on its immediate use (within 20 years) must be clarified. Development on other electronic aids must continue. SAGE will not be the panacea for at least half a century. The military apparently thinks otherwise.

• Positive vs. VFR control has had the ACC Special Working Group 13 tied in knots for months, although the deadlock may now be broken. Some elements of the military and airlines have been pressing for an ultimate of positive control in all weather for all aircraft from the ground up. This was modified to positive control at high jet-used altitudes and extended down to the ground at high-density terminal areas. Aircraft Owners & Pilots Association has fought this latter proposal.

That the deadlock may be broken was indicated in a recent speech by Lowen, who visualizes "a happy compromise" between the two schools. "Perhaps only a few highly congested routes and zones might have to be placed on a full IFR control basis. Elsewhere, the IFR requirement would be confined to the high altitudes," he said.

• The evolution of the Common System will never take place if a central development authority is not established.

The jealously guarded development perogatives of the military and civil agencies must be broken down—without infringing on the military's primary mission or creating the best defense network in the world. The bars of security established by the military must be reorganized to separate the true security from the budgetary security of huge sums of money spent on devices that are not essential to the defense buildup.

• An operating agency, with sufficient power over all users, must be created in some form.

• Development and operation by committee must be halted so true progress can be made to meet the industry needs.

Mr. Curtis has been chosen to accomplish the impossible. It has been a long time coming. ◈◈◈

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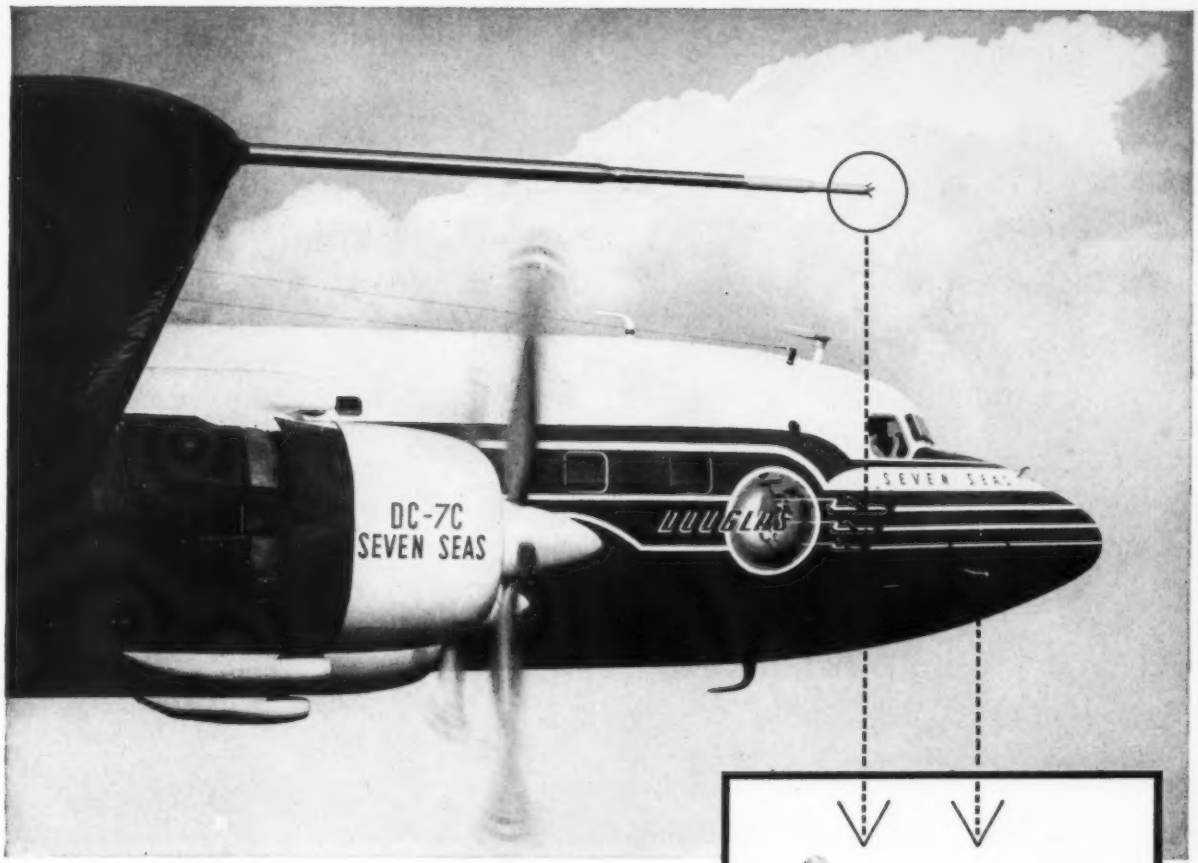

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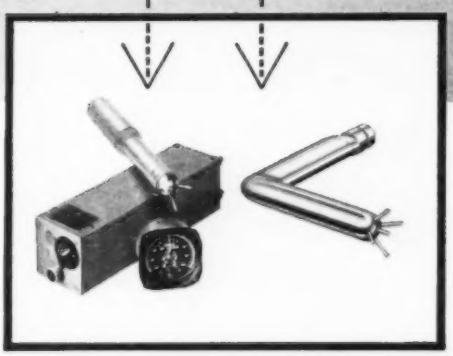

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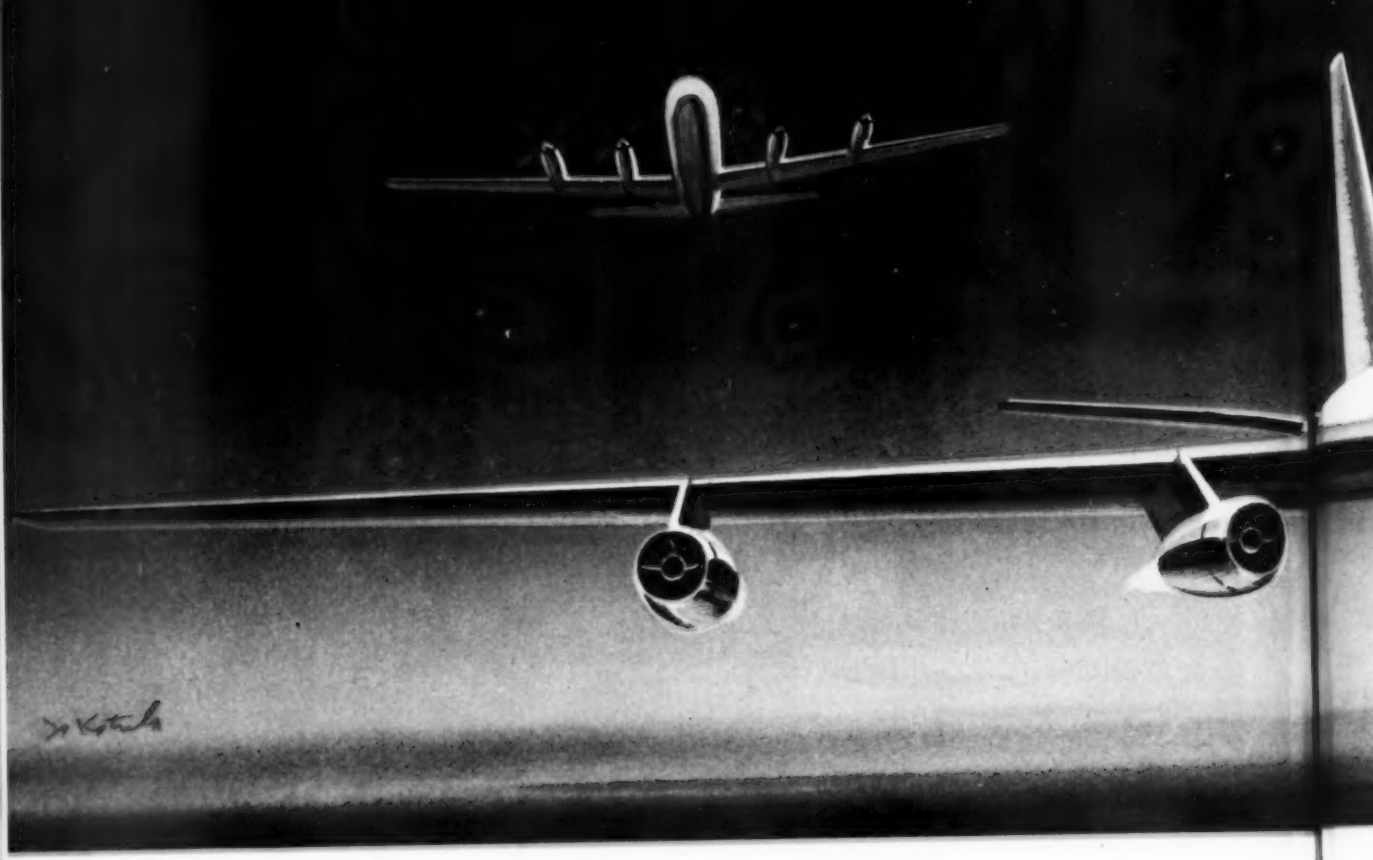

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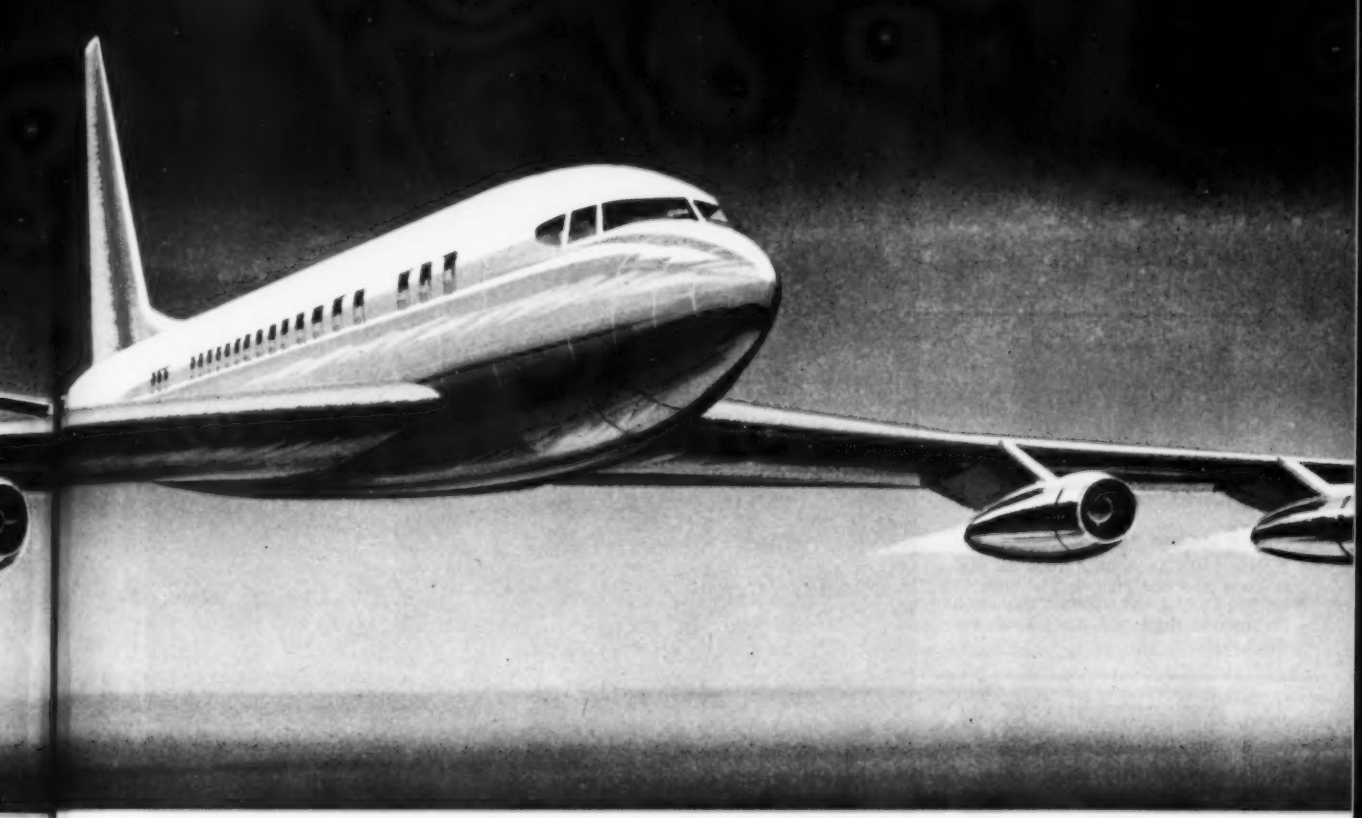

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What Top Civil, Military Officials Think About Air Traffic Control Situation

U.S. Committed to Truly Common System

By EDWARD P. CURTIS

Special Presidential Assistant for Aviation Facilities

During the past year or so the strain on our existing aviation facilities has caused increasing concern in all segments of the aviation community. This universal concern is the result of the expansion of military jet operations, the mushrooming volume of business flying and general aviation, the increased operations of our commercial airlines, and the prospect of efficient jet transports flying commercially in 1959.

These facts have finally brought our entire aviation community face to face with the harsh reality that we must plan ahead to prepare for a system of aviation facilities which will make possible the safest and most efficient use of our airspace. We must have a system which will not only permit the normal development of our Nation's civil and military air potential, but which will serve to stimulate the development of that potential.

This country is committed to the policy of a truly common system of air traffic control. I propose to adhere to that policy in undertaking the job of Special Assistant to the President for Aviation Facilities Planning.

I realize the job I have undertaken for the President is not an easy one. I am already acutely aware of the dynamic pressures affecting aviation which are at work within the government and industry, which somehow must be reconciled if aviation progress is to be orderly, swift, and in the best interests of the United States.

I am, however, most encouraged by the sincere interest and the frank desire of all segments of U. S. aviation to get on with the job. With this continued cooperation and support I am confident that decisions can and will be made which will enable U. S. aviation to meet the increasing public demands and provide for our national security.

ACC Integration Program Approved

By LOUIS S. ROTHSCHILD

Under Secretary of Commerce for Transportation

The President's Air Coordinating Committee has been dealing with the air traffic control problem as a matter of highest priority. The President has recognized the importance of a thorough examination of this air operations subject at the very highest level as evidenced by his appointment of Mr. Edward P. Curtis as his Special Assistant for Aviation Facilities Planning. I am most gratified with this development and as Chairman of the ACC, as well as in my capacity of Under Secretary of Commerce for Transportation, I have offered to provide every assistance which Mr. Curtis may request of us in the furtherance of his all-important aviation study.

I am happy to report that insofar as air traffic control policies are concerned, the ACC has approved a program to accelerate air defense and air traffic control integration, including present and future developments that involves the USAF multi-billion dollar SAGE air defense program.

The report of the Second Air Operational Policy Group (SWG-13) of the ACC NAV Panel has been under almost daily finalization review by the Panel and is expected to be issued next month. This most comprehensive report will encompass the broad problem areas of the common civil/military system of air traffic control and navigation including new procedures, radar, communications, and airports together with means of implementation both for the immediate future and for longer term planning. It will be capable of use as an immediate basis for Common System planning and programming, and will, of course, be provided to Mr. Curtis.

Additionally, the ACC has recently approved a five-year CAA facilities plan for air traffic control and navigation for the period of 1957-1961. This CAA plan as approved by ACC was transmitted to the Congress by the Secretary of Commerce Sinclair Weeks along with a request for the funds to implement the fiscal year 1957 portion of this plan. The plan, amounting to almost a billion dollars over the five-year period, will be continuously coordinated by the ACC and will, of course, be subject to change both as new circumstances dictate and to accommodate the findings which Mr. Curtis may recommend as his long-term study progresses . . .

The ACC has presently under evaluation in the Washington area new procedures designed for the alleviation of high-density air traffic conflicts during VFR conditions. Upon completion of this evaluation and receipt of recommendations by the NAV Panel's Special Working Group 8, procedures which will beneficially affect this situation are expected to be extended to other high-density terminal areas in the United States.

The Air Force View

By GEN. NATHAN F. TWINING

U.S. Air Force Chief of Staff

Here is the basic problem: Increasing the capacity of the system immediately to meet the requirements of its users now and in the foreseeable future.

The CAA has done a remarkable job in handling the tenfold increase in traffic since the inception of the Federal Airways System. A current five year program to improve on the existing system by the CAA has the full support of the USAF.

The Air Force must be able to operate its aircraft with as few restrictions as possible, employ them to the maximum of their designed capability and operate them safely under all weather conditions. With jets we can operate high above normal air traffic.

A major control problem is the climb and descent through lower altitude flight paths. Fuel consumption puts a premium on this phase of jet operations. To gain the absolute maximum performance, jets must fly from point to point rather than follow established air routes. All these factors add to the control burden of the CAA.

Traffic at high altitude is rapidly increasing. Even under complete VFR conditions near collisions are increas-

ing. High speeds increase the rate of closure, and pilots must be always on the alert to the possibility of such near collisions.

To increase the system capacity we need the following:

(1) A system of navigational aids which provides continuous azimuth and distance information.

(2) A much improved system of transferring, processing and displaying aircraft data to the Air Traffic Controller.

(3) Improved and expanded direct pilot to controller communications.

(4) Expanded use of radar, both en route and terminal area.

(5) Improved altimetry.

Air defense and air traffic control have different missions. But the successful accomplishment of both missions is dependent on the ready availability of identical information —namely, aircraft detection, position and identification. Both control take-off time, route, altitude and recovery. Not only do they require identical information, but in some circumstances, their functions overlap.

The CAA has its AMIS (Air Movement Information Service) positions in it air route traffic control centers. All instrument and defense VFR flight plans are reviewed and the necessary flight data is passed to air defense. The bulk of these positions are financed by the Air Force.

These two functions require a maximum exchange of information. Whatever developments occur in the field of air traffic control in the future, the highest possible degree of compatibility with air defense should be established.

Requirements of Air Traffic Control

By CHARLES J. LOWEN

Administrator of Civil Aeronautics, U. S. Department of Commerce

In my three months' experience as Administrator, I have devoted more attention to air traffic control than any other subject. I have started steps to improve our air traffic control service by announcing my intention to establish the Office of Air Traffic Control, and requesting substantially increased funds for air traffic control tools and personnel. This is only the beginning of our efforts.

Bold thinking is required to achieve more permanent solutions to the air traffic control. We must seek improved tools and procedures, but that cannot be done on the gadgeteering and single black box basis. Comprehensive systems analysis, using the controller as the requirements generator and the operational evaluator, is essential to success. The engineer has important essential functions, as does the pilot, and the human engineer. Each must contribute and feed back to the other.

With that background, I will state the requirements of air traffic control as I see them:

(1) **Navigation**—Ground facilities and properly equipped aircraft are required so that continuous position information will be known to the pilot at all times, enabling him to follow the ground tracks prescribed by air traffic control.

(2) **Communication**—Direct pilot-controller communications are a requirement everywhere. Voice should be eliminated as a medium of routine air-ground air traffic control communications and inter-controller communications . . .

(3) **Automation**—It may be years before we will turn decision-making and judgment functions over to machines, but certainly automatic display, computation, data display, and detection of potential conflicts between aircraft are long overdue.

(4) **Radar**—Extension of the controller's eyes through radar is as essential as extension of his ears through radio. Greatly expanded radar coverage is necessary to efficiency with today's traffic rules and is imperative with the concept of controlling all air traffic under all weather conditions.

(5) **Airports**—Airport capacity may be the bottleneck to tomorrow's air traffic control. Air traffic demands must be met by the airports of our nation, or the whole system will suffer.

(6) **Training**—Both expansion of existing service and introduction of improvements require expanded formal and on-the-job training capabilities.

(7) **Research and Development**—Research has lagged behind traffic demands, and needs to be intensified.

(8) **Support**—The CAA cannot do this job alone; it is a service agency to the users and must meet their needs. The task ahead is difficult indeed, but can be accomplished readily with support of the users, the public and the Congress.

Cooperation Essential Ingredient

By JAMES HOPKINS SMITH

Assistant Secretary of Navy for Air

The Air Traffic Control System must be made capable of a high degree of safety and also of providing for the expeditious movement of many times the amount of traffic existing today. A large proportion of this traffic will soon be of a nature entirely different from that which is handled today. High speeds, high rate of descent, and restricted endurance at low altitudes all combine to dictate a highly efficient and rapid means for controlling jet propelled aircraft.

The system must recognize different classes of users, differing operating characteristics of aircraft, and differing equipment and pilot capabilities. Service must be provided to all users compatible with their respective needs.

To develop and implement such a system is a challenge which can be forcefully accepted and met, provided all segments of aviation focus on the problem.

The immediate needs of the users must be attacked forcefully with recognition of requirements of users to operate precisely but more flexibly than the fixed airway system affords. These needs are particularly acute at the higher altitudes at which modern jet aircraft normally operate.

Procedures and methods must be employed to eliminate operation of supersonic aircraft on the "see and be seen" principle as a basic method of separating aircraft. Added attention must be directed to the solution of the high-density terminal area traffic problems. In these areas it is highly inefficient to attempt the operation of jet aircraft under the present system capabilities.

Terminal areas must be extended for control purposes to encompass jet aircraft initial approach points. In many cases this will require control zone extensions, additional equipment, and revised procedures for control in order to provide even a token service to jet-type aircraft which are now operating in the same general airspace with propeller-type aircraft. Since in the terminal areas, all types of air traffic must of necessity utilize certain common airspace, nothing short of positive control or separation of all aircraft in these areas is considered practicable . . .

To cope with the ever-expanding air traffic control problem it is considered essential that the government and

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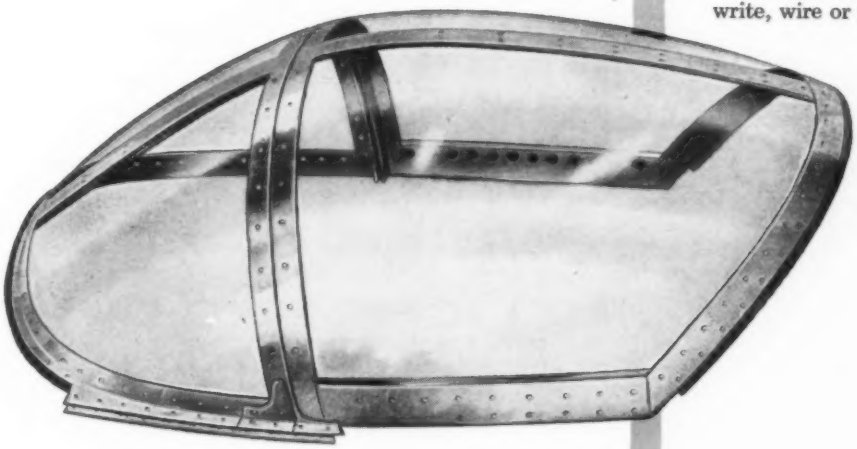

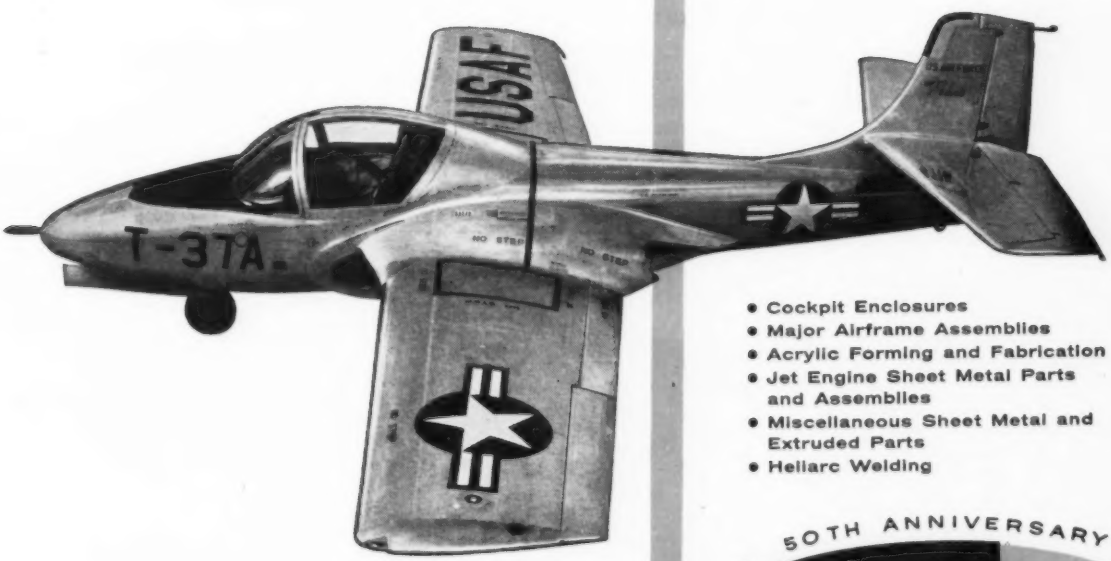

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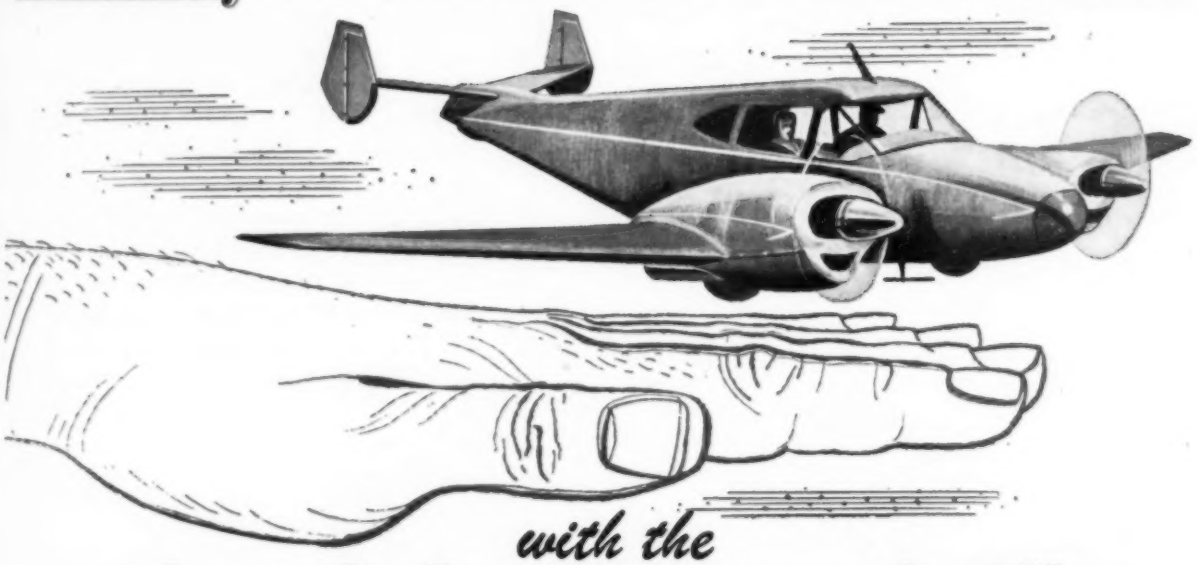

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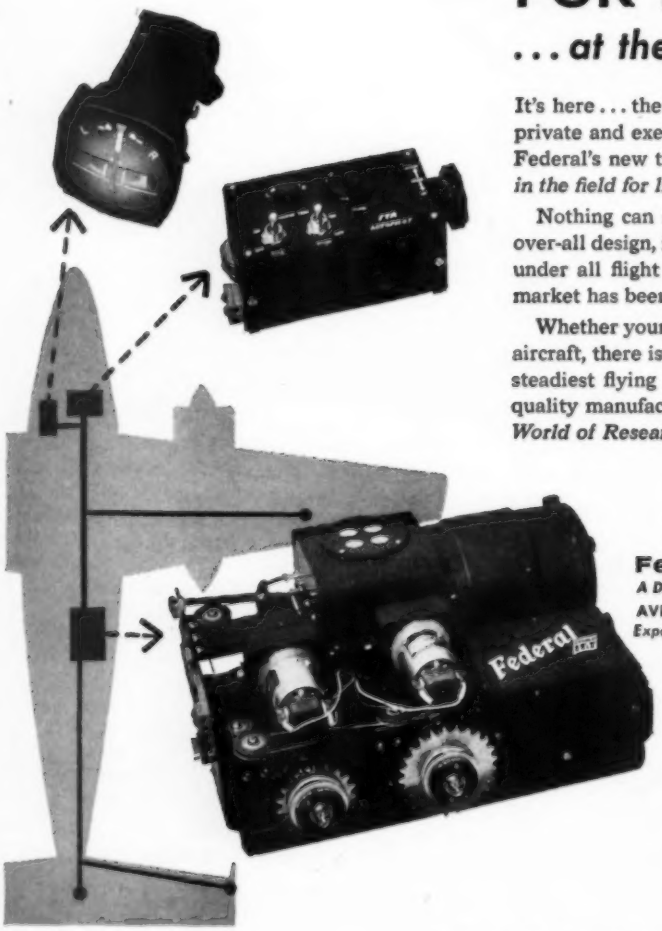

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the aviation industry accelerate the programs fulfilling the requirements for a common system. A vigorous research, development and evaluation program must be instituted to meet these requirements. This then must be followed by a national program of orderly implementation.

As a more immediate solution to the problem, the methods, procedures, and equipments now employed for the control of air traffic should be analyzed with a view toward improvements to provide positive separation initially between aircraft operating at the higher altitudes and in high density areas and later extended to the lower altitudes as the users' needs dictate.

The application of radar for air traffic control, improved communication capabilities, revised air traffic control and operational procedures, and improved rho-theta navigational aids designed to provide positive control of all aircraft in high density areas are all top priority items required to improve the Air Traffic Control System.

ATA Philosophy on Air Traffic Control

By STUART G. TIPTON

President, Air Transport Association

There must be a completely modern air traffic control system for handling tomorrow's aviation needs. It must be a comprehensive, thoroughly integrated master system, designed to accommodate all expected types of air traffic, and considerably greater numbers of aircraft.

The system should first provide for complete and constant control of all air traffic at the higher altitudes where our faster aircraft must operate, and in all high-density traffic areas. Gradually this control concept should encompass all airspace where the air traffic situation so warrants.

In such areas our goal should be positive control of all types of aircraft under all weather conditions.

We are not suggesting positive control of all airspace purely for the sake of control. Rather, we seek control for safety's sake.

Airport Improvements Vitally Important

By C. N. SAYEN

President, Air Line Pilots Association

ALPA's views are essentially those that were outlined at the Air Line Pilots Association's recent Air Safety Forum: More adequate control in the air coupled with airport improvements that will permit a smoother and safer flow of air traffic.

To accomplish this, we feel strongly that the see-and-be-seen principle is obsolete and a substitute must be found for it in an Air Traffic Control system that takes over not only IFR traffic but VFR traffic as well. There must also be a reconciliation of the critical and necessary requirements of all users of airspace free of the confusion of multiple controls with one single agency in control of all airspace.

In the airport area, size of our airports, approach lighting, and runway lighting and marking are all critical problems.

Airports of adequate size are, of course, a primary requirement. At present, we do not have a single runway on any civil airport that could handle a fully-loaded intercontinental jet transport. Many airports are just now becoming adequate for DC-3s.

Approach lighting requires standardization. Complete standardization on approach lights hasn't yet been achieved even in theory, let alone installation.

Standards for runway lighting have been achieved, but there is still the very necessary job of implementing standardized runway lighting.

Summing up, we feel that the airways and airport problem are inseparably interrelated. We are going to have to start considering the airport as part of the airways system and put the two problems together. The airway, in fact, starts at the ramp and ends at the ramp, because there isn't much use in having an efficient airway system if you can't move the airplane onto the ground. The airport becomes a bottleneck.

Airports in Industrial Communities

By HENRY W. BOGGESS

President, National Business Aircraft Association

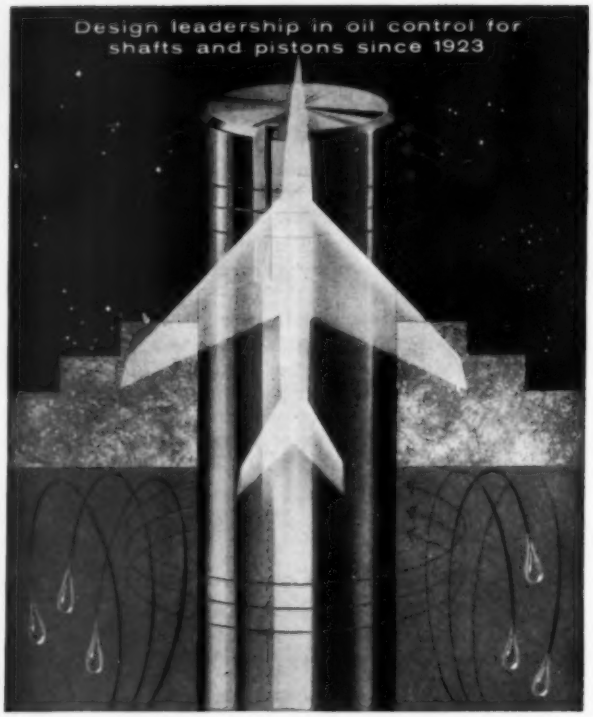
The need for air traffic control improvements has long been apparent but have been bogged down by lack of coordination between civil and military and by lack of understanding and appreciation of the problems involved on the part of both the present and past government administrations, as well as key committees of the Congress.

En route delays, interruptions of important flights, congested air traffic in high-density areas, widely varying speeds of civil and military aircraft, inadequate airborne equipment in some types of aircraft, limited piloting skill in adverse weather and flight conditions, lack of more positive control and aircraft fixes in the airspace, are a few of the factors combining to create almost intolerable conditions for operators of aircraft.

To add more complexity and to compound this confusion in utilizing the airspace, air traffic is expected to more than double within the next ten years. During that period it is forecast that extremely high altitude operations, supersonic aircraft speeds, radically new aircraft configurations, new airborne navigational and communications equipment, low altitude helicopter and possibly convertiplane (VTO) operations, will become commonplace . . .

There are numerous elements that have contributed to this deterioration of air traffic control. For instance, the lack of an adequate airport system, designed to meet specific operational needs, has resulted in non-commercial aircraft entering and departing heavily congested air traffic areas in order to enplane or deplane passengers. Unless we have airport capacity in off-airway areas, particularly in industrial locations, movement of air traffic will continue to be hampered by aircraft flights that have no other place to land or take off except at busy terminals.

It is NBAA's opinion that airports in industrial communities, like highways, are a public necessity. Another element is the long-prevalent and slow-changing "airway route concept" which has hindered full utilization of the newer "airspace area concept." Adoption of the latter, would speed point-to-point flying with minimum deviation from the desired course. Lack of adequate air navigation aids, however,



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to permit area flying has inhibited the natural flow of air traffic directly to predetermined destinations and has added to the growing hazard of crowded airspace in certain densely populated sections of our nation . . .

The magnitude of the problems in this field demanding right solutions by aviation experts is almost overwhelming but not by any means insoluble, especially if the best thinking of the airspace users is devoted to finding answers to the strictly operational phases. As an added urgency for solving air traffic control problems, we must bear in mind the possibility of our nation facing a sudden emergency. Almost overnight, air traffic movements could rise to astronomical figures . . .

In visualizing the air traffic control system of the near future, I am convinced that it must satisfy the needs of all airspace users, imposing only minimum hardship on any segments, civil or military, in terms of airborne equipment and complex procedures.

This concept includes utilization of the airspace by minimum and fully equipped aircraft, the probable future establishment of satellite airports in high density areas for fundamentally differing traffic, the channeling of ultra-high-speed aircraft to and from high altitudes through well-delineated air corridors to major terminals, and the subsequent evolution, development and implementation of new and radically different airborne equipment which will simplify and expedite the mounting flow of air traffic.

Civil Fliers Have Rights, Too

By J. B. HARTRANFT, JR.

President, Aircraft Owners and Pilots Association

The Air Traffic Control system is just one part of the entire Federal Airways system. Its sole and comparatively limited purpose is to control safely and efficiently the flight of aircraft under instrument-flight conditions, when such control is beyond the capabilities of the pilot himself. Thus the ATC system today actually is concerned with about 10% of all the flying done in the United States.

The deficiencies of the ATC system are well known and have been widely discussed. These deficiencies must be corrected promptly, and on a high-priority basis. But in correcting these deficiencies, the other 90% of flying done in the United States must not and cannot be unduly penalized. Whatever form the ATC system may ultimately take must be such that all users of the air space have free and equal access to that air space, so long as they meet practical minimum safety standards.

Any effort to force the 90% to conform to the wishes of the 10%, or get out of the air, can only meet with failure.

Instrument flying as we know it today will never be dominantly used by the vast majority of civil-aircraft fliers for as far into the future as we can see. The United States Government must recognize that fact in developing whatever ATC system appears to be needed to serve that portion of the total air traffic that wants to fly solely under the control of such a system.

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Four-Year Safety Record Set by Airlines

Fatality rate again held below 1.0 per 100 million passenger-miles in 1955 as traffic increased by 17.5%

U.S. scheduled airlines, riding the crest of a 17.5% increase in passengers carried and a similar jump in passenger-miles, made 1955 their fourth consecutive year of operation with a fatality rate below one per 100 million passenger-miles.

Although eight major accidents brought the fatality toll to 158, highest since 1951, record traffic gains in transporting 41.3 million passengers 25.1 billion passenger-miles produced a final fatality rate of 0.63.

•**But even more significant** than their performance last year is the fact that U.S. carriers have registered for four years in succession a safety statistic they never once achieved in the 22-year history of their operation prior to 1952. And this despite operating some 82.5 billion passenger-miles during the four-year span, about 8.5 billion more than they flew between 1930 and 1951.

Virtually the whole accident record for 1955 was written in domestic trunk airline operations which accounted for seven of the eight incidents and 156 of the 158 fatalities.

Local service carriers, helicopter and territorial operators completed the year without a single passenger loss while flying 3.5 million passengers some 632 million passenger-miles.

•**U.S. international airlines** suffered only two fatalities in transporting 3.4 million passengers 4.6 billion passenger-miles for a fatality rate of 0.04 for every 100 million passenger miles they operated.

Stratocruiser Ditched

The lone accident in this operation came in March when the crew of a Pan American World Airways' Boeing Stratocruiser was forced to ditch the transport in the Pacific Ocean 35 miles off the coast of Oregon. A propeller blade failure resulting in loss of the No. 3 engine from the B-377 probably caused the accident, Civil Aeronautics Board later found.

But in domestic trunk airline operations it was a different story. Preliminary CAB figures show these carriers flew an estimated 34.4 million passengers 19.9 billion passenger-miles to record a fatality rate of 0.76 per 100 million passenger miles.

•**Of the seven major incidents** during the year, the "Big Four" airlines (American, United, TWA and Eastern) accounted for six. A Braniff accident at Chicago during approach to Midway Airport was the seventh.

And this does not include one other incident listed by CAB on the airline record but not figured in safety statistics. This was the November 1 loss of a United Air Lines' DC-6B at Longmont, Colo., which resulted in 39 passenger and 5 crew fatalities, but was later charged to sabotage.

Tracing the year's accident record brings to light certain new elements tending to affect the airline safety picture.

For example, the first incident of the year could be classed as "unavoidable" from an airline operating standpoint, but surely reflects unfavorably on present-day air traffic control methods. This was the collision of a TWA Martin 2-0-2 with a privately owned DC-3 near Covington, Ky. resulting in 10 passenger and three crew fatalities.

•**Although CAB found** the DC-3 was operating in the Cincinnati traffic control zone without proper clearance, it is apparent that more positive traffic control possible with the use of radar to detect "illegal" aircraft might well have prevented the incident.

And this same air traffic problem, which has increasingly imposed the "see and be seen" principle as the pilot's only assurance against collision may have influenced five of six succeeding accidents during the year.

For in each case it was evident that the pilot's routine navigation or approach practices were being influenced by some unknown pressure to fly with his eyes out of the cockpit instead of on the instrumentation for navigation

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or approach intended to prevent exactly what occurred.

Some Examples

• **On February 19** a TWA Martin 4-0-4 struck Sandia Mountain eight minutes after takeoff from Albuquerque, N. M. CAB concluded that the pilot failed to conform to established en route procedures and deviated from the airway at an altitude too low to clear the obstruction.

During approach to Springfield, Mo. on March 20, an American Convair 240 "landed" over a mile short of the airport resulting in 11 passenger and two crew fatalities. CAB here found crew inattention to their flight instruments, possibly compounded by sensory illusion as to the true position of the aircraft, was the probable cause.

In two other approach accidents (Braniff at Chicago on July 17 and Eastern at Jacksonville on December 21) the same "out the window" navigation tendencies are evidenced, although CAB's report on the latter accident is not yet completed.

• **In the Braniff accident,** the Board found the probable cause to be loss of visual reference by the pilot during final approach resulting in an increased rate of descent at an altitude too low to recover.

In only two accidents (American at Camp Forney, Mo. and Pan American off the Oregon coast) did mechanical troubles play a role in 1955. The AA incident was charged to use of an unairworthy engine cylinder which failed six hours after installation. A resulting engine fire led to in-flight loss of a wing during an emergency approach.

In other airline services, the 1955 safety record shapes up like this:

•Two U.S. helicopter services—New York Airways and Los Angeles Airways carried 28,746 passengers (a 242% increase over 1954) and operated 684,000 passenger-miles without incident.

•Certificated cargo operators suffered two accidents, one involving a Flying Tiger DC-4 on September 24 in the Pacific Ocean west of Honolulu and the other a Riddle Airlines C-46 near North Hollywood, S. Car. on December 17.

•Nonscheduled airline domestic operations saw two accidents totaling 27 passenger fatalities. A Currey Air Transport DC-3 was lost near Burbank, Calif. on December 8 after experiencing engine trouble immediately following takeoff but brought death to two crew members only. The second, a Peninsular Air Transport DC-4, crashed after takeoff from Seattle on November 18, resulting in 27 passenger and three crew fatalities.

CAB report on the cause of this incident has not been issued.

•Military Air Transport Service, completing more than one million flying hours for the first time in its history during 1955, also hit a new high in operating safety. MATS finished the year with an accident rate of 6.06 per 100,000 flying hours, the lowest since the service was established in June 1948. ◈◈◈

THE 1955 ACCIDENT RECORD

The year 1955 saw these major airline accidents classed below by type of operation:

Crew	Airline	Aircraft	Fatalities Crew	Fatalities Pass.	Cause
Domestic Scheduled					
1/12	TWA	2-0-2A	3	10	Collision with private DC-3 illegally operating in control zone.
2/19	TWA	4-0-4	3	13	Pilot non-conformance with en route procedures resulting in collision with Sandia Mt.
3/20	AA	240	2	11	Pilot inattention to flight instruments during approach; possible sensory illusion.
7/17	BNF	340	2	20	Pilot momentary disorientation and loss of visual reference during final approach.
8/4	AA	240	3	27	Failure of unairworthy engine cylinder resulting in engine fire and loss of wing.
10/6	UAL	DC-4	3	63	Struck Medicine Bow Peak, Wyo. Cause not yet reported.
11/1*	UAL	DC-6B	3	39	Sabotage.
12/21	EAL	L-749	5	12	Crashed during instrument approach at Jacksonville, Fla. Cause not yet reported.
International Scheduled					
3/26	PAA	B-377	2	2	Suspected propeller blade failure resulting in loss of No. 3 engine from aircraft.
Certificated Cargo					
9/24	FTL	DC-4	3	0	Loss of power No. 3 engine account faulty fuel management; faulty restarting methods resulted in ditching.
12/17	Riddle	C-46	2	0	Cause not yet reported.
Irregular Domestic					
9/8	Currey	DC-3	2	0	Engine failure immediately after takeoff and pilot's irrevocable decision to land without establishing position and runway alignment.
11/18	Peninsular	DC-4	27		Cause not yet reported.

** Listed on airline accident record but not included in computing safety statistics.*

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System Engineering Outmodes 'Many-Black-Boxes' Concept

Mechanization of clerical work achieved by data-processing machines, but traffic control problems remain unsolved.

(EDITOR'S NOTE: Modern electronics technology is being employed to solve some of the most pressing problems of the commercial airlines, especially for purposes of record-keeping, reservations and other clerical tasks, but in the field of commercial air traffic control it is getting third-rate treatment.

(In his analysis of the latest trends in systems engineering and the mechanization of clerical work through the use of self-regulating electronics equipment AMERICAN AVIATION'S *Electronics Editor, Henry P. Steier, presents an interpretation of the airlines' underlying philosophy in coping with their multiplying problems. At the same time, he outlines the difficulties that still beset manufacturers, engineers, government officials and military authorities in attempting to solve the even more complex air traffic control problem.)*

Part 1

By HENRY P. STEIER

A striking aspect of the electronics picture in commercial aviation is the degree to which the principles of the most modern trends in systems engineering and mechanization of clerical work have (or have not) rubbed off on the industry's most urgent technical problems.

Today's answer to many problems whose sheer size and qualitative demands elude human capacity is supplied by self-regulating machine systems or data-processing systems. The speed and versatility of electronics has recommended it as the means of tying together the varied elements of a control or clerical problem.

Through electronics technology, systems feed information back and forth through themselves and become self-regulating. This, the closed-loop technology, is the essence of automatic control. Synthetic memories carry on tapes, magnetic drums and in tiny magnetic cores vast quantities of data available in microseconds to the user.

Growth Outruns Predictions

•**Commercial aviation's** g r o w t h seems destined to outdistance even the most starry-eyed prognostications. Growing too, in relative proportion, are the number of black-boxes-on-board commercial aircraft. In terms of the most advanced system engineering, the black boxes are outmoded by reason of their independence.

Pilots, ATC controllers, telephone operators, radar operators—each man operates as the terminus of a communication loop in a complex network of ATC communications and information exchange.

As the complexity of transport operations increases so does the need for information exchange with the fixed element in the air traffic system—the ground. So do the number of black boxes built to help with the job.

•**During the last twenty years** that aviation has mushroomed, the capability of electronics has been producing changes in the technology and management of complex problems in organization and control.

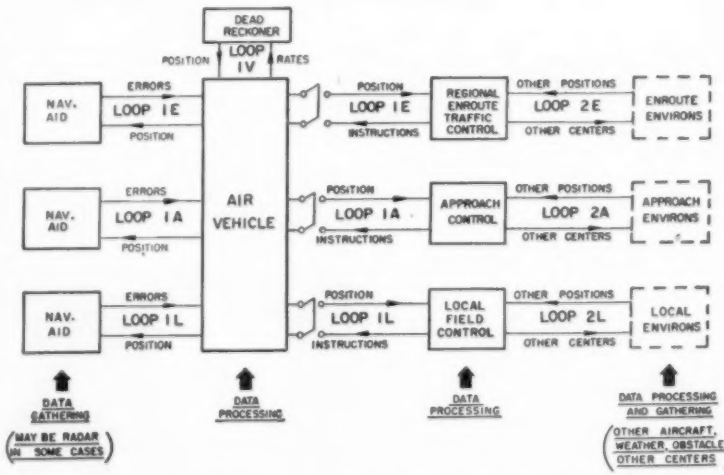
The problems have a remarkable likeness to processes of life and the tides of human affairs. The right hand knows what the left is doing because there is communication or "feedback" between them. Feedback, or more generally, interdependence permits them to manipulate to best advantage.

The sophistication of automatic control technology today is evident in the growing number of robots, or control systems, that minister to the complex needs of different jobs. They set the pitch of airplane propellers, adjust control surfaces for maximum performance, run complex refining processes. But, when it comes to assuring the safe, expeditious flight of commercial aircraft, one enters the old-fashioned world of the "open-loop" system.

'Conundrum' of Air Age

Control of air traffic in its three-dimensional element has been called the "conundrum" of the modern air age by Gen. Peter C. Sandretto, technical director, Federal Telecommunication Laboratories. "It has been stated that air traffic control is simply a problem in servo-mechanisms," Gen. Sandretto said. If this is true, he added, "the tightness of the servo loop is determined by the national law on the subject of air traffic control."

•**In the work** of automatic control the "closed-loop" is imperative. Here, as in the human being, the whole is greater than its parts. As expressed by Gordon S. Brown, Massachusetts



INDIVIDUAL CONTROL LOOPS in an ATC system that would be considered for system analysis by the Air Force. Connecting lines are data transmitters. Loops labeled "errors" would correct air derived information. Loops 1A and 2A are under study by the AF TRACAL (Traffic Control Approach and Landing) system engineering group. According to AF engineers, limits on rate of navigation data flow between ground and a large number of aircraft requires an information loop independent of the ground radar traffic-control loop. TACAN, VOR and Navarho are examples of such a loop. However, they say, pulse modulation techniques in the "future" system could provide 1,000 aircraft with data from a 300-mile radar.

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Systems Engineering Required

Out of the technology of automatic control has come recognition by engineers and scientists that each part of a communication or control system must be designed as part of the unitary whole. This means designing the system *for* control as well as designing the controls. It calls for "systems engineering."

This new species of engineering pools the resources of professionals—mathematicians, scientists, engineers of all types and administrators. They have been referred to as "orchestrators" of the new technology. The first fruits of the work of these feedback-system engineers becomes more evident each day and especially in military weapons systems—Nike, B-47 and B-52 bombers, the SAGE (Semi-Automatic Ground Environment) system developed at Lincoln Laboratory.

The men who developed these systems synthesized the whole picture before making black boxes for the system. It was such a system problem that Special Committee No. 31 of the Radio Technical Commission for Aeronautics faced in prospect when they met in 1947-48 to synthesize the ATC situation and design of a system that would meet both military and civil requirements, and provide a "common solution that is best for each service."

U.S. AIRLINES PLANNING TO USE WEATHER-MAPPING RADAR

Radio Corporation of America:	American Airlines, Inc. Continental Air Lines, Inc. Pan American World Airways, Inc. Trans World Airlines, Inc. United Air Lines, Inc.
Bendix Radio Division, Bendix Aviation Corporation:	Eastern Air Lines, Inc. National Airlines, Inc. Northwest Airlines, Inc. Pan American-Grace Airways, Inc.
Collins Radio Co.:	Delta Air Lines, Inc.

These U.S. scheduled airlines have installed some units, or plan to install, weather radar in their fleets. No statistics are available on the effect of using this aid to passenger comfort and schedule maintenance. Most carriers are in the process of installing the equipment as it becomes available.

•**How far** civil aviation got with the RTCA "Common System" in nearly a decade is evident when one compares equipment in the racks of air transports today against the equipment evolution chart of RTCA's report. With a few exceptions, ground and airborne equipment today looks pretty much the same functionally as it did in 1948, excepting there is more of it

Prerequisite: Management Awareness

What happened? A prerequisite to successful system engineering is management that has raised its thinking to the systems level. The technical staff must be directed to work as a team. The chief engineer in one field cannot expect to have control or authority over all matters in his field.

A new breed of engineer has evolved that has been referred to as a "borderline engineer." These are engineers, who, in the course of their work in the new technology, "crossover" into fields other than the one in which they got their basic training. The term implies too a consciousness of the inter-relationship of all the sciences that is needed for successful systems engineering.

Between 1948 and now, to use a favored military argument for successful systems engineering, there has been no "prime contractor" with overall authority to develop a civil ATC system. The Civil Aeronautics Administration as "technical authority," the Air Coordinating Committee as "policy coordinator" and the Air Navigation Development Board as "development program coordinator" between military and civil agencies have been merry-go-rounding in the midst of the ATC conundrum without sufficient funds, either to keep the present black boxes supplied with enough and the right kind of signals or to implement the present "system" with stop-gap closed-loop measures.

•**System-level thinking** has certainly not been existent nor possible considering the loose organization, part-time participation of some groups, security-clouded state-of-the-art and lack of overall technical management.

The military, however, armed with the funds for military security measures have gone ahead and developed their own traffic control concepts, together with a lot of miscellaneous black-box hardware to see them through the "systemless" era.

A question foremost in civil aviation's mind is whether Air Force techniques for air defense and ATC will be "here" in time to meet the new problems of jet transport operations before economic losses and accident rates

PHASE	TYPE	PROD. SPEC DATE	INSTALLATION ERA
I IN BEING	MANUAL	PRIOR TO JAN 1954	
II "PRESENT"	MANUAL MANUAL-RADAR	JAN 55	1955-1958
III "TRANSITION"	SEMI-AUTOMATIC MANUAL-RADAR	JAN 59	1959-1963
IV "FUTURE"	AUTOMATIC, SEMI-AUTOMATIC MANUAL-RADAR	DEC 1962	1963-1968

GI2628

PHASING OF USAF TRAFFIC CONTROL SYSTEM DEVELOPMENT

STEPS IN U.S. AIR FORCE "global" air traffic control system development. RAPCONS (Radar Approach Control Centers) are being installed under Phase II programming. VOLSCAN (approach-path scheduling radar) and automatic Ground Control Approach Radar would come in during Phase III. Phase IV is now in "techniques research period" and this system is "being planned to meet anticipated needs of air transportation as forecast for 1965," according to AF engineers.

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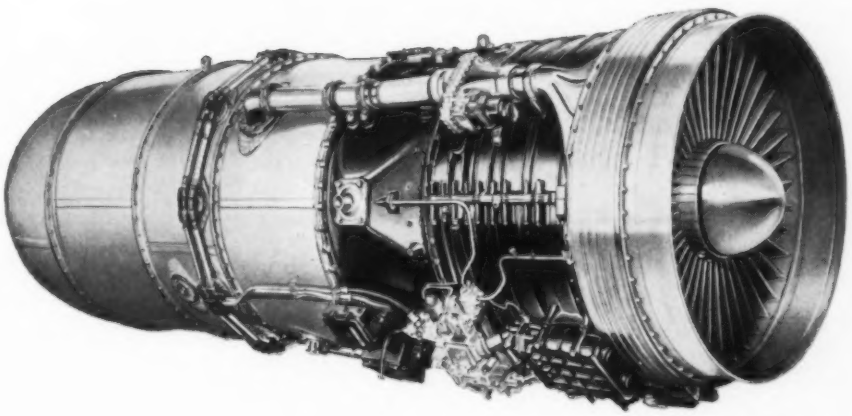

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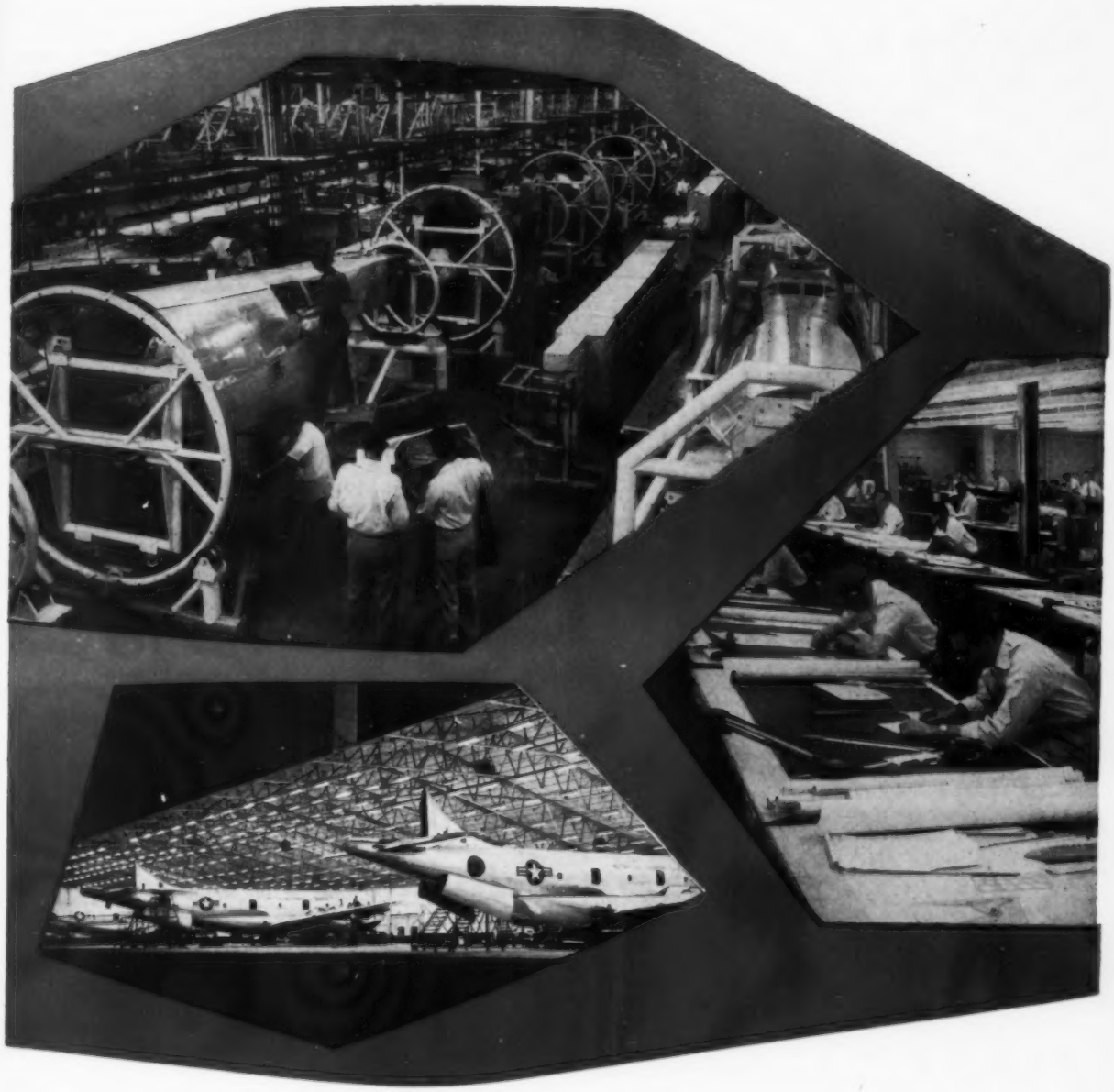

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increase, and aircraft technical gains are negated.

•**Unfortunately** the commercial transport is a constant speed device. Jets are particularly sensitive in this respect. Even now, present aircraft must perform as variable speed devices to meet safety, airways capacity and airport capacity limitations. This costs the airlines money and passengers inconvenience.

The rate of acceptance of our airports would present a dilemma to any systems designer. Feedback in any automatic control system enables it to self-regulate. Too much feedback, such as might occur because of slow acceptance airports that we now have, would in an otherwise self-regulating system cause what system designers call continuous oscillation. When this occurs, the control system becomes useless.

Air Force View Given

A talk by Joseph L. Ryerson, Rome Air Development Center, and entitled, "Traffic Control Research Goes Modern" was delivered before the Institute of Radio Engineers convention in March. What he said sheds some interesting light on Air Force planning and point of view. Ryerson declared "System engineering has finally displaced black-box fire-fighting to solve the problems of military air traffic control."

The Air Force, Ryerson said, is doing a system analysis at Rome "to formulate a rational plan for a global air traffic control system, with 1964 as the target date." The system would be "an integrated, manually backed-up automatic monitoring and control system for traffic control with timed-feed to an automatic approach and landing system."

•**He predicted** the technique "should provide a stepping stone to the improvement of our antiquated civil system" and "would prove that the men of science, both government and industry, can give our nation the economical and efficient technique to eventually rid us of subjective opinions and politically-plagued black boxes."

The AF plan covers six flight phases: (1) departure; (2) enroute; (3) initial approach; (4) final approach; (5) flare-out and landing, and (6) taxiing. Flow of information is completely in closed-loop form, with stand-by controllers to take over in event of sub-system breakdowns.

For timing of the development, three conceptual phases are considered necessary: (1) utility of existing facilities; (2) orderly transition and (3) research and development on the advance system, concurrently with present and transitional periods.

The AF concept calls for radar as a "traffic aid" and Tacan as the navigation aid. Ryerson said aircraft must be provided with a navigation aid independent of the traffic aid. One part of the system calls for an inertial-type dead-reckoner sub-system periodically corrected by system-derived information.

The "physical embodiment," said Ryerson, would include in the Phase III period of 1964 major sub-systems such as an "electronic geographic coordinate navigation system in the enroute flight phase, automatic scheduling for approach, automatic approach and landing, and automatic airfield surface guidance."

•**The system sounds like** Prof. Brown's "grand design." The degree of control on the military ATC system is enhanced by a tight control-loop dictated by martial law. In civil aviation, CAA prescribes the tightness of the loop by prescribing the rules. As the rules stand, much is left to pilot initiative. Things could not be otherwise considering the open-loop system we have with the pilot as the terminus of many communication loops.

Perhaps President Eisenhower's new Assistant for Aviation Facilities Planning, Edward P. Curtis, may become the civil ATC "Czar." He might well heed the admonition of Ernest Nagel, professor of philosophy, Columbia University, who in writing on advances

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in automatic control and the recent formulation of its principles, said:

"When human intelligence is disciplined by the analytical methods of modern science, and fortified by modern material resources and techniques, it can transform beyond recognition the familiar aspects of the physical and social scene. There is surely a profound difference between a primitive recognition that some mechanisms are self-regulative and others are not, and the invention of an analytic theory which not only accounts for the gross facts but guides the construction of new types of systems."

This kind of systems-engineering thinking will no doubt be a major controlling factor in the successful development of an ICBM missile. Perhaps some of it will rub off on civil aviation's ATC problems, under Curtis' guidance.

Part II

Airlines' Business Methods Updated By New Data-Processing Machines

The extent to which the electronics technology is rubbing off on the airline business is strongly marked by the "head-on" treatment airlines are giving to the challenges of personalized customer service, increasingly complex interline exchange of information and increased accounting loads.

Personalized service is a tradition the airlines want to protect. Seat reservation is part of that service. Despite the growth and size of the industry, personalized service on a mass basis is still an accomplished fact.

Processing data on tens of millions of airlines passengers each year is a gargantuan clerical job. Keeping Joe Doe happy in the knowledge that a seat he ordered weeks ago is waiting for him has not been an easily met goal.

• **Keeping accurate records** of the vast store of data on seat inventory has tried to the limit the human-recorded clerical system used by most lines.

American Airlines Led Way

The help of advanced electronic techniques made its mark back in 1952 when American Airlines, Inc. and the Teleregister Corp. developed an availability/inventory data-processing system. The special purpose system, called a Magnetronic Reservisor, was installed in AA's New York ticketing area.

The Reservisor has proved its value to AA through reduced reservation-system costs, error-reduction, more rapid transactions, reduced office space. Handling over 40,000 interrogations per day in peak periods, the Reservisor obviously speeds-up passenger-agent relationships and improves customer relations on that score alone.

A more recent addition to the system enables it to answer questions on flight "early" or "late" arrival times in increments of five-minute periods. This is another great assist in public relations.

With this system, seat availability is determined and seats sold through a flight agent's handset. The handset is a small box with switch buttons, located at ticket sellers' stands in terminals.

Coded metal cards are inserted to select and insert information on different flight legs.

American is now in the process of increasing the storage capability of its New York-based system to include more flight legs. A manual storage version of the system using availability panels is being installed by American at other points in its system. These form a storage system maintained by human operators who insert or remove inventory information displayed on plug-board panels.

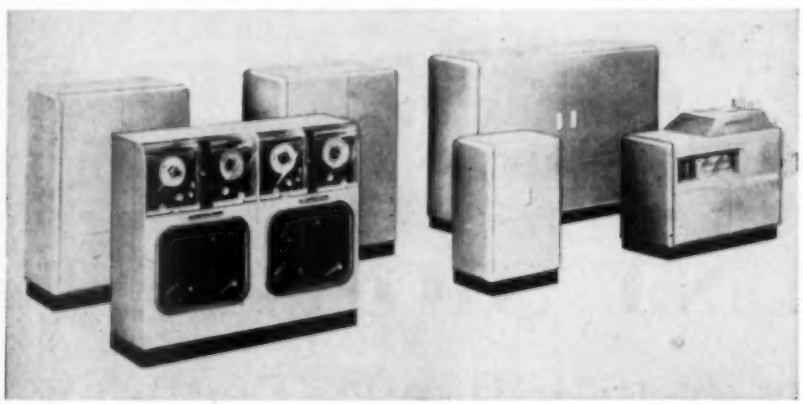
• **United Air Lines,** Pan American World Airways and National Airlines have or will install availability systems at points on their routes. Braniff Airways is planning installation of a Reservisor system throughout its route system, using a magnetic drum storage as in the AA system.

Northwest Buys Univac

Northwest Airlines has announced purchase of a new entry into the reservations data-processing equipment field, the Univac airlines reservation system using the Univac file-computer, made by Remington Rand Univac division of Sperry Rand Corp.

The new equipment marks a departture from "special purpose" systems used thus far. Its appearance on the market brings into the airline business a question recurrent in other industries and argued constantly by makers and users of data-processing equipment: whether what is known as a "special purpose" or "general purpose" system is most economical for given needs.

Generally, special purpose data-processors are said to be more economical, because only the hardware to do a specific job is needed. The machine is custom-made to handle repeated processes of a similiar nature. The "in-



TICKET AGENT SET for use with Univac Airlines Reservation System. A cartridge of ordinary 2 x 2 inch slide transparencies is inserted in the chamber at the lower right corner. Information on the slides is in much the same order as on present airlines timetables, with the addition of codes for set operation. Slides are moved into place as needed and an image of the timetable projected on a ground glass screen. Keys near the screen select origin and destination cities. Other buttons select date the seat is desired, type of transaction and information on flight status. Above is File Computer equipment that stores and handles data. The system can accommodate ten magnetic storage drums, each capable of storing 180,000 characters (15,000 twelve character words).

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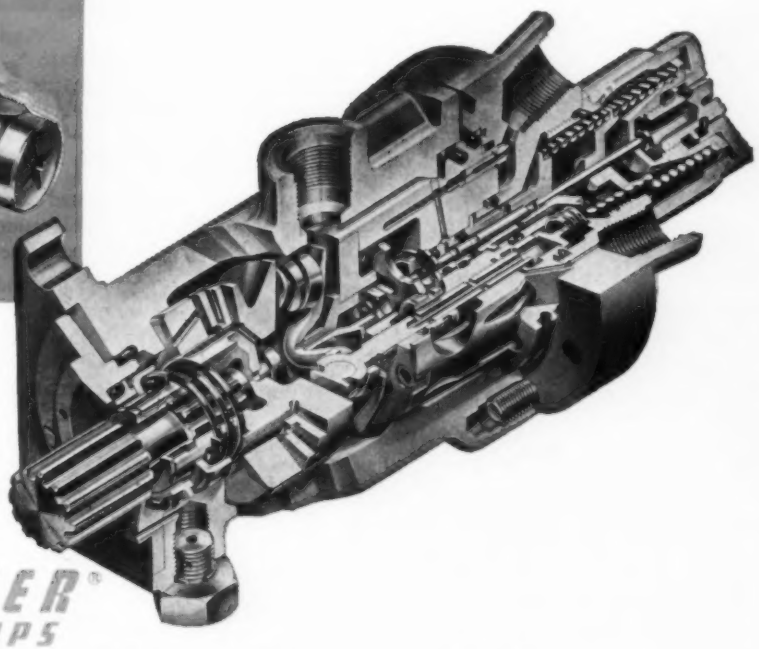

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WHEN Radio Materials Corporation of Chicago, manufacturers of electronic components, added a new plant 135 miles away in Attica, Ind., it solved an expansion problem but ran into a transportation problem.

Executives shuttling between the two facilities were losing valuable working hours enroute. Road travel meant a three or four hour trip and even when using the company's fixed wing airplane, the two hours by auto between plants and airports couldn't be overcome.

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Radio Materials Corporation's experience with the time and money saving features of Bell helicopters is typical. These helicopters provide safe and quick transportation at low initial and maintenance cost. They are the most widely used helicopters in the world.

structions" and "logic" built into the machine are fixed.

General purpose computers are built to manipulate a variety of information in a number of ways, since a large "repertory" of machine logic is available. Data-processing machines of general-purpose character have been described as "inherently lazy." Everything is done in these machines in milli- or microsecond time. Since there might be many microseconds between operations for a given job, the philosophy has been to utilize, or time-share the machine's time between jobs so that it does not rest. This is done by increasing the repertory of instructions together with adding peripheral equipment such as magnetic tapes, typewriters, etc. to store and deliver information.

Modular, or interconnection possibilities inherent in the Univac system enables it to offer prospects for a wide variety of applications to airlines business. The computer time can be shared between reservations and other business functions such as revenue accounting, payroll accounting, etc. If desired, the central computer it uses can be shared with another airline. These possibilities are expected to be particularly appealing to intermediate-size airlines that might not be able to support for reservations alone, a system costing approximately $400,000.

Cost Gap Narrowing

As expressed by Charles G. Abbott and Warner G. Cumber, of American Airlines, in a talk before the Reservations Committee of the Air Traffic Conference this year, the cost gap between the special and smaller general purpose computers is narrowing. They reported: "The cost of storing each bit of intelligence is declining. Thus the low-order general purpose apparatus emerges as a competitor."

How far the present trend to the use of electronic seat-availability and inventory data-processing will extend is not known. A possibility that looms is the development of an inter-airline system that will do far more than is possible with today's separate and relatively incompatible systems.

• **Even now** there are predictions from ATC Reservations Committee members that present equipment will be out-moded in five to eight years. They say solutions to a "common system" design will eliminate the human equation in transmitting information and permit the airlines to meet the challenges of an expanding market, decreased flying times and narrowed profit margins.

Results Expected

Abbott and Cumber listed these basic ingredients of a future system:

• Input equipment of many types—tapes, punched cards, voice, manuscript readers.

• Large storage—variable in increments of a million characters or more.

• General purpose controls—a large array of logical orders available.

• Output equipment—tapes, cards, or printed copy.

• Random access-mode of machine operation not requiring extensive sorting and batching of information.

The results expected from such a system would be:

• Automatic fare computation and filing.

• Automatic preparation of manifest—passenger and load.

• Automatic ticket preparation.

• Automatic transmission of reservation status and fare to ticket offices.

• Automatic action on expired ticketing time limits and notification.

• **As the first step** toward the ultimate system, American Airlines will experiment with a data-processing machine believed to be an International Business Machines type 650 electronic data-processing machine.

Buffalo Experiment

In a simulation project, work with the 650 machine will attempt to determine if a machine can be programmed to construct logical messages and

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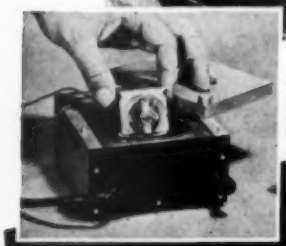

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then "reason" their addresses. Buffalo, N. Y. was chosen as the site for the simulation tests.

Objectives of the Buffalo experiment are:

•Increased accuracy—records and transmitted data.

•Mechanization of repetitive tasks in reservations offices.

•Rapid reservations data—processing on an intra-and inter-office basis.

•Reduction in volume of work in progress, called "the float."

A standard tabulating card was chosen as the source document. Marked by flight agents, these cards will be the "input" and will produce 5-channel punched teletype tape and typewritten copy as outputs.

The tape will be automatically fed to the teletype system for transmission of messages and automatic direction of them to the appropriate airports and carriers.

Out of the tabulating card experiment AA expects to learn a great deal about the implications for automaticity of future inter-airline procedures. Much will be learned about the "common language" requirements so that procedures are "logical" to both individuals and machines.

'Soul-Searching' Decision

It is ironic that in another area of airline business the tabulating card has been referred to as a "limiting" and "imprisoning" factor in handling fiscal data. John S. Woodbridge, comptroller for Pan American World Airways, before a seminar of airline executives said, "The fiscal nature of international air transportation has become so fantastically complex, and the documentation so volatile and negotiable, that ordinary methods of accounting and statistical control no longer suffice."

•According to Woodbridge, demands for speed, precision and fullness of information forced Pan American into advanced mechanization of accounting through large-scale electronic data-processing machines.

Pan American will lease an IBM type 705 machine, one of the most powerful now available. Delivery to the airline's new air-conditioned and humidity-controlled room, covering 2,700 square feet of area, is expected this month. Pan American's pioneering move was lauded before the House of Representatives last month for "keeping abreast of the electronics age."

What handling of the airline's data, stored on magnetic tape, will mean to its office procedures was cited in terms of the 1.5 billion tabulating cards the company machined last year. "Machining" a card is the work performed each time an operation is performed on it. Pan American reached the saturation point in handling its records and controls, and so demoted the cards to second place.

Information formerly processed at a rate of 15,000 cards per hour will be processed at the equivalent rate of 500,000 cards per hour. A 2,500-foot-long magnetic tape weighing 2¼ pounds contains data equivalent to 60,000 cards completly filled in.

Citing Pan American statistics, a complicated ticket is sold every five seconds of every working day, hundreds of interline waybills are issued every hour, inventories are in "astronomical figures," and the prospects of these figures are magnified with the approaching jet age. Woodbridge said the airline arrived at its decision during months of "soul searching research."

Three Objectives Set

• The airline set three objectives for their study of the 705 application:

•Removal of limitation of information in an 80-column card and substitution of limitless capacity per unit of information.

•Elimination of the interruption in data-processing due to use of a variety of machines.

•Improvement in quality of management information.

Seven thousand times per day Pan American sells a ticket somewhere in the world. In some cases the tickets have as many as 50 flight coupons covering flights on other carriers lines and over multiple flight legs.

This immense volume of sales is passed to an account called "unearned transportation revenue." Details are maintained on tabulating cards with one card for each flight coupon of each ticket. Each two tickets have been averaging five tabulating cards. Use of the flight coupons is reported to the airline through lifted coupons and billings from other airlines, and the inventory of unearned transportation revenue is relieved by using the tabulating cards to attrition the inventory.

At present the inventory is maintained in a given month on about 400 tightly packed trays of tabulating cards. The equivalent data will be contained on 10 reels of magnetic tape. Cards will still be used to prepare the tape, although now data from a number of tickets can be punched on one card.

• The passenger revenue operation will require about 40 programs on the 705 machine. For this and other uses 90,000 programs are contemplated. The machine will also process data for cargo revenue, statistics, payroll, materials inventory and general business books.

The total passenger revenue job that took 4,000 hours of machine time each month will now be done in 15

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JUKE-BOX-TYPE SYSTEMS for recorded announcements in airline terminals have been installed by United Air Lines, Inc. Use of such devices is expanding and permits uniform, clear and pleasing announcements to be made. Console of the J. P. Seeburg Corporation's Select-O-Matic system handles 200 announcements, remembers—juke-box fashion—selections so airlines are served in turn.

hours on the electronic data-processor. Woodbridge says his department will now be considered more of an "indispensable arm of the sales department" than formerly.

Some new types of sales ammunition being developed to produce the most revenue include:

- Report of business derived from individual shippers in the U.S., including sales area, destination, weight, number of shipments, revenue and type of commodity.
- Cargo commodities, by carrying divisions of the company, including classifications, weight, number of shipments and total revenue.
- Weight brackets, by carrying divisions. This would be used to determine the type of ship that produces the most revenue, the type needed to produce more revenue and the type readily carried by flight equipment used in peak aad low seasons.
- **Prospects exist** for the use of transceivers that permit duplication of tabulating cards at great distances from the originating location. Using one telephone circuit and four transceivers, 35,000 cards could be automatically reproduced in 14 hours.

When the 705 is operating in Pan American's New York office, the airline will be well prepared to meet future increased volume of business with room to spare for new machine applications. The machine will cost $360,000 to rent each year. Increased efficiency and its supporting role in the management of a big business will undoubtedly speedily pay for the rental.

It has been said of big business that "the time between occurrence of events and the moment that corrective action must be taken is narrowing relentlessly." Data-processing by electronic means has been and continues to be developed to make up time needed in this dynamic era of business management. ◈◈◈

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LOCKHEED YC-130—MATS' budget provides funds for the Lockheed Hercules, now in production at Marietta, Ga. The 108,000-pound aircraft is powered by Allison T56 turboprop engines of 3,750 eshp.

MATS to Become Bigger, More Business-Like

Military flying service to absorb Navy's FLOGWINGS and will adopt industrial fund basis for better cost control

By HENRY T. SIMMONS

A bigger and more business-like Military Air Transport Service is in the offing, despite strong recommendations from the Hoover Commission last year to curtail the scope of the carrier's operations.

The Pentagon in December decisively rejected the Hoover Commission proposal to restrict MATS' activities, but it did adopt the Commission's ideas for a comprehensive reorganization of the Air Force-operated carrier, which hauls passengers, patients and cargo for all three military services. The major features of the reorganization:

- Absorption by MATS of all regular-route military air transport operations, including the Navy's Fleet Logistic Air Wings (FLOGWINGS).
- Conversion of MATS to an industrial fund basis for better cost control of its far-ranging activities over 115,000 miles of global routes.

What Merger Will Do

The merger of FLOGWINGS into MATS will create a single, unified fleet of about 680 government-owned transport aircraft, including about 550 four-engine planes. It will strengthen MATS' position as the largest U.S. air cargo carrier in terms of ton-miles, and move it closer to the Big Five U.S. airlines in terms of passenger-miles. (See chart.)

In addition to FLOGWINGS, MATS probably also will assume responsibility for managing the Air Force Air Materiel Command's LOGAIR and the Navy's QUICKTRANS. LOGAIR, operated by civilian carriers using leased government aircraft, hauls high value supply items to AMC's 15 air materiel areas within the U.S. QUICKTRANS, conducted by private operators using both government and privately-chartered aircraft, performs a similar service for the fleet.

Details of the merger have not yet been worked out, so it's impossible to say when it will be put into effect. As a first step, the Air Force has prepared a broad policy statement concerning the consolidated air carrier. When this is approved by Defense Secretary Charles Wilson, work on the details may go forward more swiftly.

The second feature of the MATS reorganization, industrial funding, is by no means a new idea. Almost three years ago, the House Appropriations Committee emphatically urged industrial funding for MATS. The scheme received much consideration in the Pentagon, but it finally bogged down because of Air Force opposition.

Now, however, the prospects for a MATS industrial fund are brighter than they have been for a long time. In its comment on the Hoover recommendations, the Defense Department breathed new life into the idea with the statement:

"Provision of airlift to the using military agencies on a reimbursable basis will . . . result in improved logistic planning insofar as the use of air transport is concerned, provide a better gauge of the efficiency and effectiveness of air transport operations than is now available, and provide an effective means of controlling the use of air transport service."

How It Will Work

Under the industrial funding concept, MATS will be set up as a kind of independent corporate entity within the Defense establishment. Instead of seeking Congressional appropriations each year to finance its operations, it will "bill" its customers as airlift is supplied. Its rates will reflect such direct costs as fuel, oil and maintenance, although indirect costs and depreciation will not be included.

The effect of this type of organization, according to one Pentagon enthusiast, "is nothing short of revolutionary." Its big impact is the fact that it encourages both managers and customers to keep an eye on costs, he explains. "For the customer, it raises the question, 'Is this the best way for me to use my money?' For the manager, 'Am I running this outfit as efficiently as possible?'"

In the Defense Department budget presentation for Fiscal 1957, it was stated that MATS would go on an industrial fund basis "beginning in (Fiscal) 1957." Authorization to transfer $50 million from the Army and Navy industrial funds was requested. The money will be used by MATS as "capital" to finance its operations until reimbursements from its military users be-

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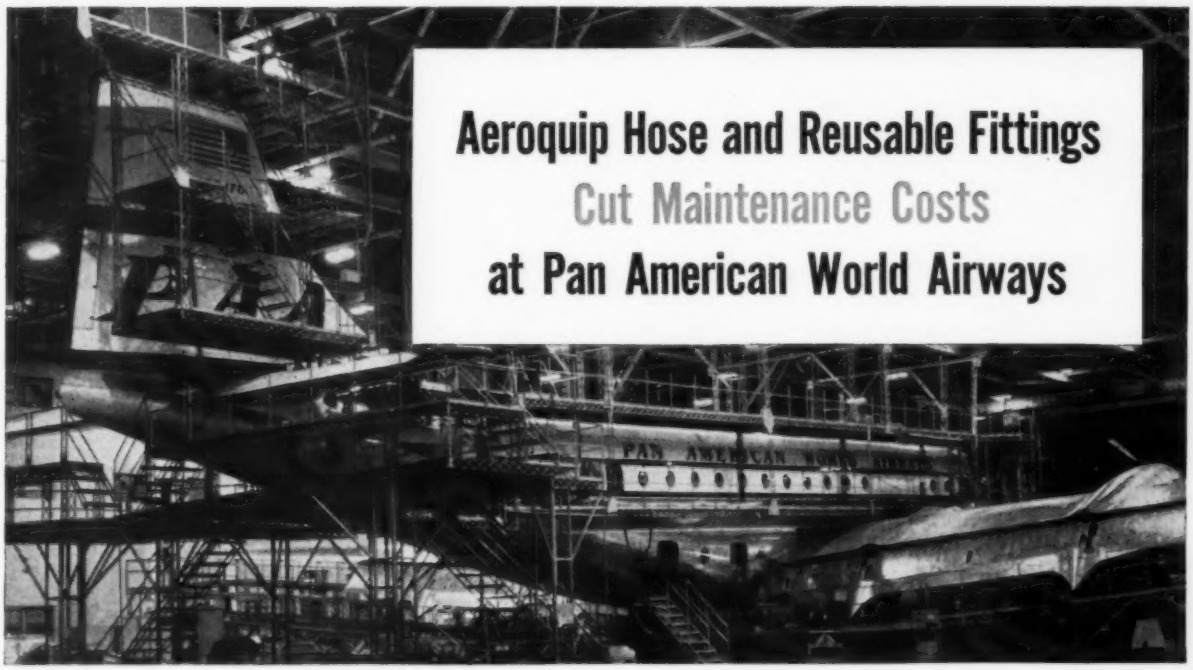

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Pan American's Overhaul Base in Miami, the largest commercial aviation maintenance base in the world, keeps a fleet of 100 Clippers in top flying condition.

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PAA Master Mechanic John Jones installs an Aeroquip Hose Assembly on a DC-7 fuel system.

PAA Master Mechanic Myron Rightmyer, of the hydraulic shop, checks inside of hose lines with a glass.

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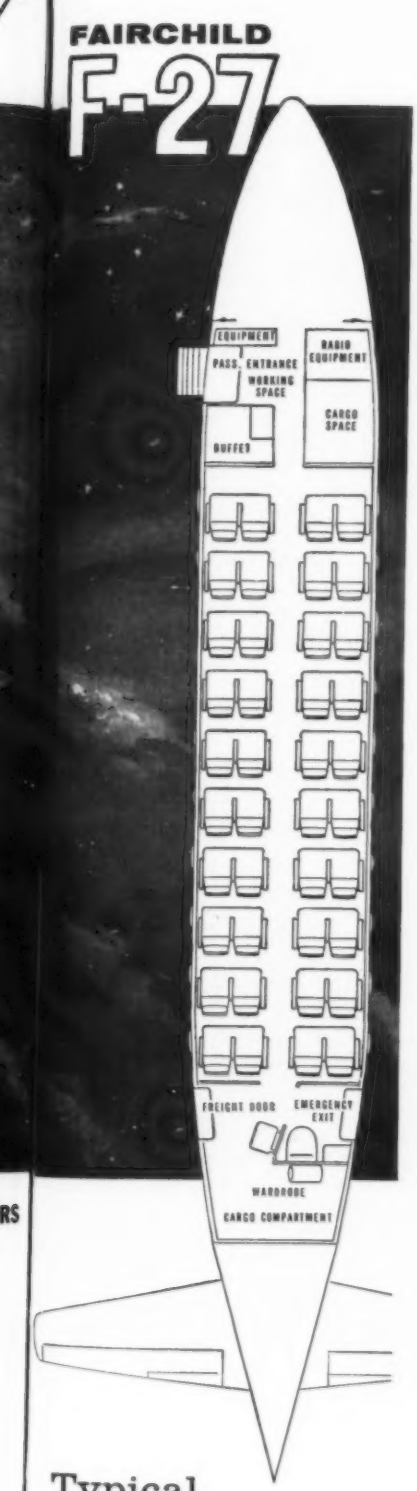


Typical 40-seat airliner layout.

DOUGLAS C-133A—MATS expects to have one dozen of these giant, 255,000-pound turboprop transports in service by the end of 1957. Basically a freighter, the C-133A is designed to haul 25 tons of cargo non-stop 4,000 miles, or 50 tons over distances up to 1,000 miles. First flight is scheduled for this month.

gin to flow back into its accounts under the new system.

"Plans for the MATS industrial fund are definitely rolling along now," the Pentagon official declared. "I don't see why the funding shouldn't be completed by July 1, 1957."

Only the air transportation phases of MATS will be covered by the fund. The organization's five special services —Air Weather, Air Rescue, Airways and Air Communications and Flight—will probably remain attached to MATS, but they will not be funded because they are not susceptible to that type of financial control.

The forthcoming reorganization of MATS is a far cry from the arrangements pushed by the Hoover Commission. While the Commission was interested in seeing an end to duplication and waste on the part of the government's various air transport activities, it was still more anxious to divert a substantial portion of MATS' business to private carriers. Therefore its most significant recommendation urged that military airlift be used "only after commercial carriers have been utilized to the maximum practicable extent."

Reasons for Rejection

The Defense Department made two points in rejecting the proposal:

• The primary purpose of MATS is to serve as a "hard core" for expansion of military airlift in event of war. To do this, it must be maintained at a

LOCKHEED YC-121F (top) and BOEING YC-97J—These are serving as flying testbeds for Pratt & Whitney T34 turboprop engines of 5,700 eshp, scheduled to power the C-133A. MATS is testing the aircraft at Kelly AFB, Tex., in preparation for delivery of the C-133A.

high level of effectiveness in peacetime.

• Since high readiness is crucial, it would be economically unsound to turn to commercial carriers when adequate military airlift is available for the job.

These principles were amplified in considerable detail by Defense Secretary Wilson in testimony before the House Defense Appropriations Subcommittee. In response to extended questioning by Rep. Daniel Flood (D-Pa.), Wilson declared:

"Any increase in the civil airlift capacity to the national defense benefit must be achieved on a balanced and sound economic basis. It cannot be nurtured solely by Government traffic to the detriment of military airlift force, and it must recognize that as civil airlift use increases in time of peace, demands are created which must be met in time of war if the war-supporting economy is to carry out its role successfully."

• **Thus the status** of MATS and the scope of its activities would appear secure, at least as far as the Defense Department is concerned. Criticism continues, however, from such influential groups as the U.S. Chamber of Commerce. It is not out of the question for a movement to develop in Congress to clip the carrier's growing wings. But this appears remote at the moment, and will probably remain so as long as U.S. commercial carriers continue to enjoy booming business.

MATS and the Big Five in 1955

(Domestic and International)

Airline	Ton-Miles (000's) Cargo and Mail	Revenue Passenger Miles (000,000's)	Revenue Passengers
MATS ..	741,062	1,586	733,400
American	98,074	4,324	7,321,000
United ..	80,034	3,954	5,540,000
TWA ...	64,941	3,443	4,002,000
Pan. Am.	105,701	2,638	2,110,000
Eastern .	31,258	3,534	6,662,000

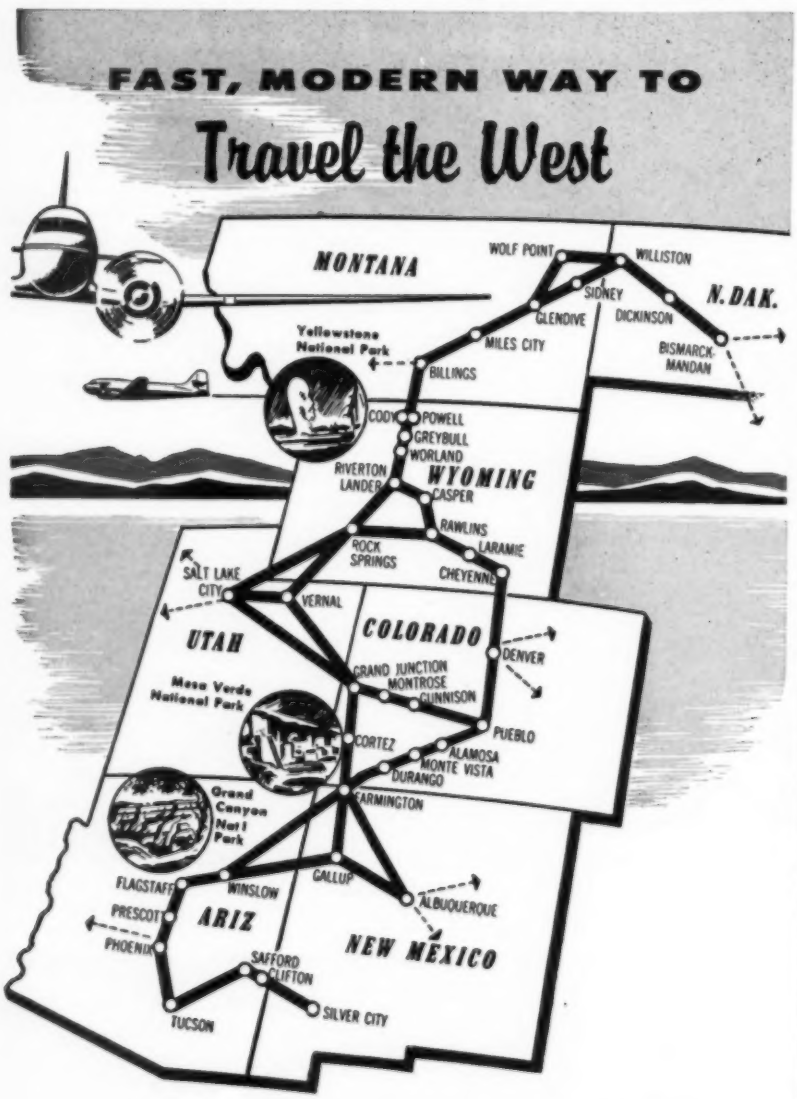
For the future, MATS is looking forward to a substantial boost in its capacity through the introduction of new equipment. It expects to have 12 Douglas C-133 cargo transports by the end of 1957, with the first to be delivered late this year. Its budget also provides funds for the Lockheed C-130 and the giant Douglas C-132, still in the engineering stage. All three are turboprop aircraft.

No funds are provided for purchase of DC-6s or Lockheed Super Constellations, nor does MATS have any funds for jet transports.

• **MATS' present fleet** of four-engine transports numbers almost 450. In addition, the service operates about 100 twin-engine aircraft. Security considerations prevent an exact breakdown, but the composition of the fleet may be roughly put at: more than 100 C-118 and R6D aircraft (DC-6 type), more than 100 C-54s (DC-4 type), more than 100 C-124 Globemasters, more than 50 C-121C and R7V aircraft (Super Constellations) and almost 40 Boeing C-97s. The twin-engine aircraft, mostly Convair C-131s, are used for air evacuation and "VIP" transportation.

According to Lt. Gen. Joseph Smith, MATS commander, the carrier last year "flew farther and carried more high priority passengers, patients and cargo for the Armed Services than at any other time in its 7½-year history." As a whole, including its special services, MATS *logged* 1,180,000 flying hours, with transport activities accounting for 568,000 hours compared with 483,362 hours in 1954.

On a global basis, MATS carried an estimated 783,400 passengers and patients last year, some 200,000 more than in 1954. It airlifted 139,263 tons of cargo and mail, compared with 91,012 tons a year ago. It chalked up 9,260 Atlantic crossings and 7,500 Pacific crossings during the year. Safety-wise, MATS last year achieved its lowest accident rate per 100,000 hours since it was created June 1, 1948. ◆◆◆



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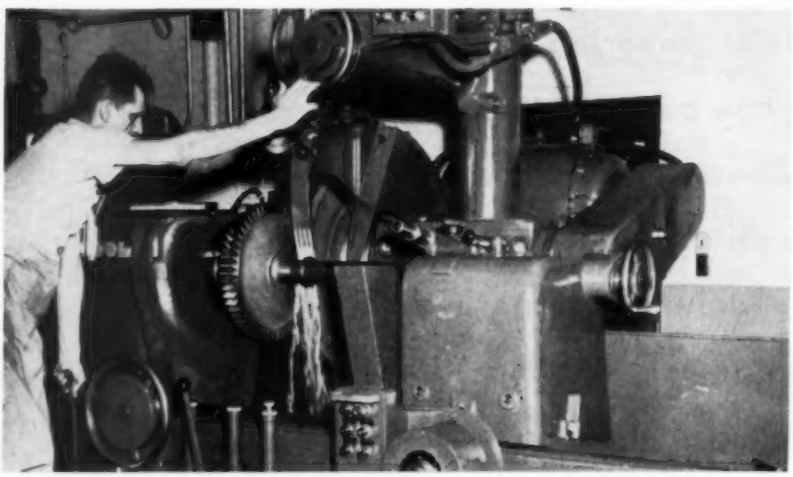
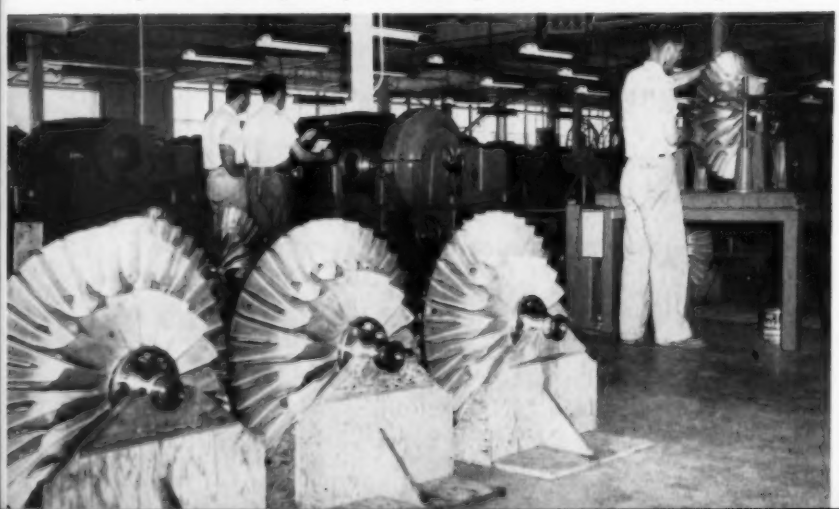
Conveyor system to handle heavy jet engines from teardown to final assembly was needed at Southwest Airmotive.



SAC acquired a large external grinder, not needed for pistons.

Compressor rework requires Dynetric balancing machines (center, left background).



DALLAS—With the operation of jet transports by the airlines, comes the vital need to provide for overhauling and maintaining gas turbine engines. The large trunk carriers, such as American and TWA, most likely will undertake the task at their own overhaul bases. Presumably, the carriers that will at first operate just a few transports will either contract with overhaul bases or make arrangements with the engine manufacturer.

Whatever the method used, large capital investments are imminent. What the overhaul agencies can expect may be seen in the experience of Southwest Airmotive Co., the first and only commercial facility currently maintaining Air Force J33 engines.

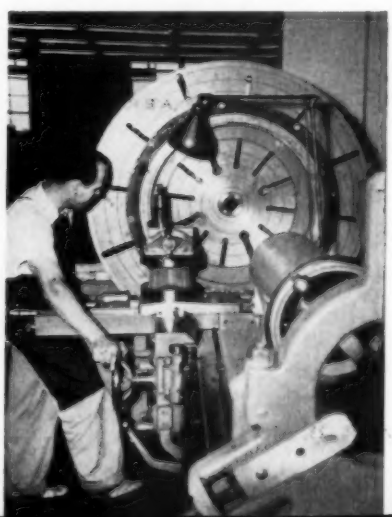
• **While the jet is simpler** to overhaul because of fewer moving parts, Winston Castleberry, SAC executive vice president, told AMERICAN AVIATION, its increased size and power presents new complexities.

Overhaul particularly of accessories has been found to be more complicated.

Piston and gas turbine overhaul tooling are for the most part "no kin to each other," Castleberry said. He estimated that $100,000 in special hand tooling alone is needed for the jets.

Castleberry also estimated that about $1½ million must be invested in equipment alone, not counting new brick and mortar for work area and test cells. Examples of needed installations by SAC before beginning its jet program included: 80-tons of air conditioning to cool the water used in the test benches which must be kept below 75°; nearly double the electric

Precision engine lathe for larger parts was installed, believed to be the largest of its kind in industrial Dallas.



power needed for pistons, particularly for the accessory shops; pressurized room for accessory overhaul to keep dust and dirt out; and, because of the large size of jet engines, a conveyor system which travels from teardown to final assembly was mandatory.

• **Special machine tools** which SAC had to acquire for its turbine contract included: dynetric balancing machines to assure perfect balancing of the turbine blades, which cost about $35,000 per machine; Reflectoscope to show up any defects in the metal parts; a precision engine lathe reported to be the largest of its kind in industrial Dallas; a Landis grinder for work on engine shafts; and a spin pit to test the turbine shaft, which runs above the specification of the engine. The latter is required by the Air Force, but, according to Castleberry, may not prove necessary for commercial engines.

SAC has found that the "age of automation" affects the maintenance of jets more than pistons. Castleberry said the job could have been done without many of the installations, such as the conveyor system, but it would have taken double the present manhours. However, he added, it has been found that much of the essential equipment acquired purely for jets can be applied to modernizing the overhaul of piston engines, as well.

Also, SAC found that it needed an arc-welding shop that had never been needed previously. While the cold section of the cleanup department is compatible for both engine types, a separate "hot" area had to be installed specifically for the jets.

• **Training of technicians** is another consideration. In order to get technical personnel up to production efficiency, 12 to 18 months of on-the-job training is specified. The time element applies to transitioning mechanics from pistons to jets or for "green" apprentices.

Specialized training is particularly required on jet fuel control accessories, which are equivalent, but not comparable, to piston carburetors. These include starting controls, fuel pumps, nozzles and emergency controls.

Test cells promise to be a delicate problem. SAC has its two test cells—which have a 300-engine per month capacity—near Amon Carter Field. The facilities have been built to J57 capacity, but it is predicted that the units, to accommodate J75s, could cost up to $2 million, depending on location.

• **As a result of a recent lawsuit,** SAC learned that concrete walls of one- to two-feet thickness are not enough to appease residents in proximity to the cells. Thirty-one residents, seeking damages, settled out-of-court when SAC promised to install noise suppression equipment which must bring the noise level down to a maximum of 108 decibels within a 50-foot radius of the cells. The equipment, known as Dura Stack, will be installed by July 1 at an additional cost of about $60,000.

Need for increased floor space is seen in the final assembly department.

Control stations such as this are required in the test cell.

While it is felt that full production will foreshorten present deliveries on overhaul equipment, it has been found that at present 12 to 15 months is being quoted by manufacturers.

Actually, the private engine overhaul bases such as SAC, Airwork, Dallas Airmotive, Pacific Airmotive and others will find more business awaiting them when the jet transports go into service.

Because of the huge brick and mortar and financial investment needed for jets, a trend is anticipated in which airlines will contract their reciprocating engine work in order to make room for doing their own jet overhaul. ◈◈◈

J33, ready for test run, is housed in steel-reinforced concrete cell, ranging in thickness from one to two feet.

Purchasing Now Major Operation for Airlines

Premium on efficiency grows as volume rises; survey shows more than $300 million was spent in '55 for gas, oil, parts, hardware, etc.

U.S. airline purchasing, until recent years relegated to more or less of a subdued "clerical" role, has finally come into its own as a vital activity in airline operations today.

Newer, more expensive transports, accompanied by the big dollar inventories they demand to insure uninterrupted operations and maintenance, have placed a new premium on buying efficiency. And results being realized are gaining for purchasing and supply specialists a new stature in airline managements.

•**Last year alone,** in addition to the hundreds of millions committed for new transports, scheduled U.S. carriers expended over $200 million for gas and oil to keep current fleets operating.

According to an Air Transport Association survey, conducted in cooperation with AMERICAN AVIATION, airlines spent better than $100 million more on such items as aircraft and engine parts, electronics equipment, hardware, rubber products, paints and chemicals.

•**Seven major trunk carriers,** representing slightly more than 75% of all domestic and international flying for the year, reported this combined breakdown of spending:

Airframe Parts/Accessories	$17,656,000
Engine Parts/Accessories	42,146,000
Aircraft Hardware	2,668,000
Prop Parts/Accessories	1,948,000
Instruments & Parts	1,362,000
Electronics	3,033,000
Radio	1,422,000
Tires/Rubber Products	1,258,000
Ground/Shop Equipment	3,554,000
Raw Materials	3,956,000
Paints & Chemicals	3,325,000
Office Equipment/Supplies	3,857,000

For these same items, four local service airlines, including large and small operators, showed these expenses:

Airframe Parts/Accessories	$339,300
Engine Parts/Accessories	200,000
Aircraft Hardware	122,000
Prop Parts/Accessories	38,200
Instruments & Parts	36,800
Electronics	128,500
Radio	298,000
Tires/Rubber Products	85,000
Ground/Shop Equipment	139,000
Raw Materials	56,000
Paints & Chemicals	82,000
Office Equipment/Supplies	157,000

•**In addition** to steering these expenditures into areas of greatest need for their particular operation, airline purchasing agents annually handle the task of disposing of aircraft surplus materials. One current estimate places total dollar value of this surplus at about $50 million. A large carrier figures its surplus value at $1.5 million.

Carrier inventories at last count were worth nearly $112 million. Of this, $109.5 million is represented by domestic trunks and almost $2.5 million by feeders.

To handle the purchasing assignment, major carriers employ anywhere from 40 to 75 buyers—local service lines average about three. All but a few airlines handle upwards of 90% of all procurement from a central purchasing office.

One good index of the extent to which "outside" spending is controlled is the limit placed on local procurement. Major airlines set limits as high as $100 a purchase, others have a purchasing manual to outline a sliding-scale allowance depending on the type of procurement involved.

But for most airlines these limits remain tight. They extend from as low as $10 up to $50 in most cases, in effect shifting the bulk of buying to centralized locations.

•**One factor** tending to change this situation as carrier buying programs gain efficiency is the cost of processing the paperwork on a single item from time of buying to settling the account. Big airlines place this cost at anywhere from $10 to $20, which adds up to a sizeable purchasing overhead considering that the "Big Four" airlines alone average about 44,000 purchase orders or supplements annually.

As to overall trends in inventory levels, the results of more modern methods of control are beginning to show. During 1955, when virtually every airline in the U.S. was adding new equipment to its fleet, seven out of 17 carriers reported downward trends in inventory.

Airlines have their own ideas on how to control inventory. Western concentrates its efforts on controlling about 15% of the high dollar items. It finds these account for 60 to 70% of all inventory.

At Braniff, purchasing officials put more stock in strict adherence to "new formula" buying practices which allow for large quantity purchase of high-

How Carriers Bought Key Items in 1955

Total procurement of key accessories and materials by seven major trunk airlines and six local service carriers, given in the following tables, shows interesting pattern of results. Quantities and costs vary widely from airline to airline because of different products and volumes purchased. (Figures for Canada are for two airlines only.)

MAJOR TRUNKS

Item	No. Procured	Cost	Average Unit Cost
Spark Plugs	655,000	$1,082,800	$1.65
Tires (new)	4,798	624,992	$130.00
Tires (retread)	17,743	596,400	$23.60
Cleaning Compounds	598,010 gals.	1,018,010	$1.70
Electron Tubes	143,007	396,388	$2.77
Electrical Wiring	3,258,050 ft.	80,019	$.024/ft.

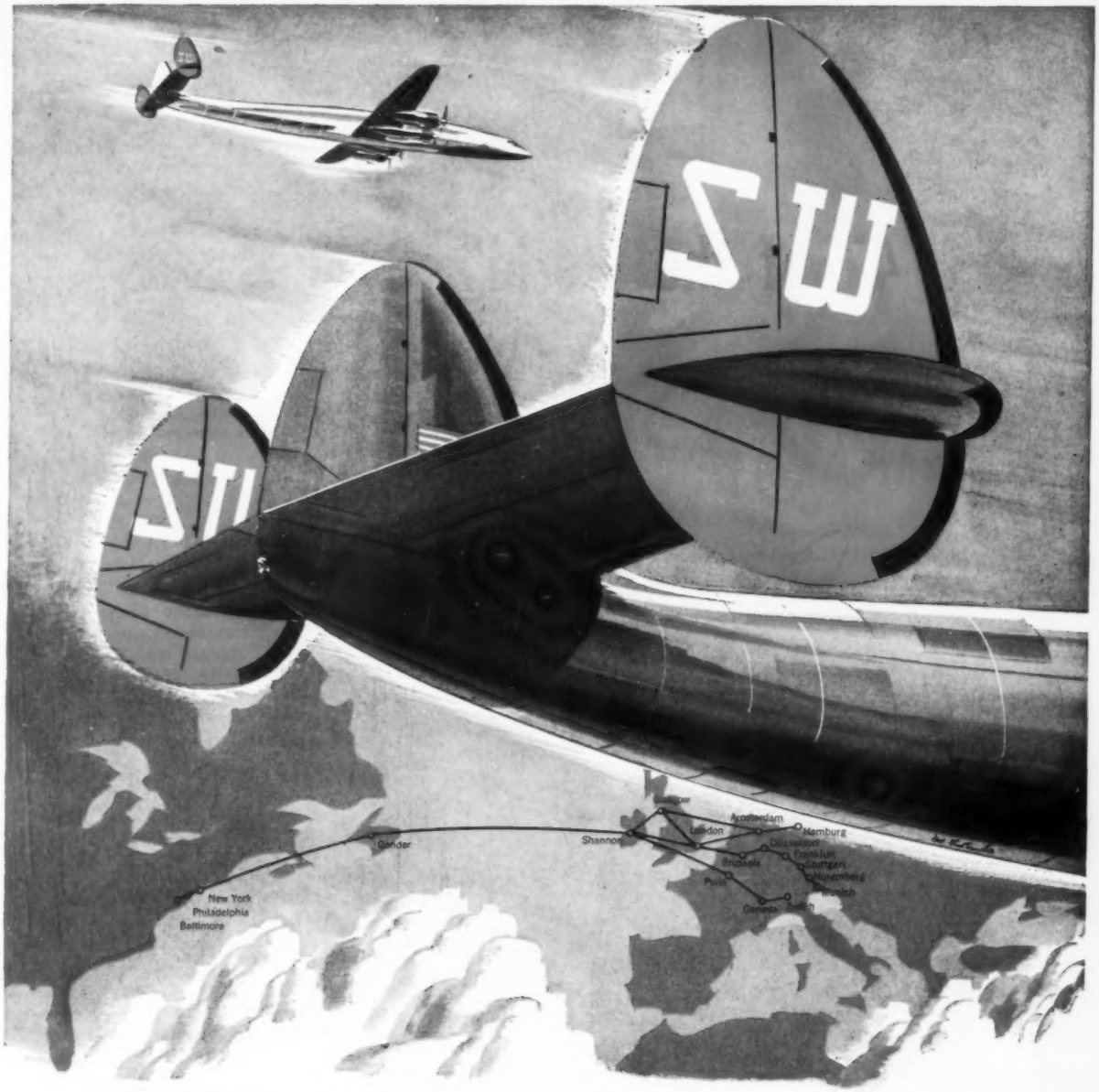
LOCAL SERVICE

Spark Plugs	7,450	$12,217	$1.65
Tires (new)	465	53,844	$115.00
Tires (retread)	781	35,521	$45.60
Cleaning Compounds*	20,537 gals.	30,355	$1.47
Electron Tubes**	10,971	26,067	$2.40
Electrical Wiring	142,720 ft.	7,193	$.05/ft.

* Four carriers only. ** Three carriers only.

IN CANADA

Spark Plugs	51,938	$126,421	$2.42
Tires (new)	516	64,924	$126.00
Tires (retread)	1,056	55,898	$53.00
Cleaning Compounds	231,232 gals.	132,954	$.57
Electron Tubes	16,509	46,359	$2.80
Electrical Wiring	529,700 ft.	23,469	$.04/ft.



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turnover, small-dollar items. This saves time and handling by eliminating repetitive small orders and long-range scheduling with no appreciable increase in inventory levels.

One of the much-discussed airline purchasing policies is to buy through distributors instead of making direct purchase from manufacturers.

Of the airlines surveyed, only one reported a policy against dealing through such organizations. But virtually all carriers are strong in their attitude against so-called distributors who are simply "order takers" operating for commission only and making no effort to stock inventory.

•**The ATA survey** produced some significant trends in airline buying of specific aircraft accessories and materials (See box, page 96).

For example, last year seven major trunk airlines bought close to 700,000 aircraft spark plugs while four local lines procured 7,450, yet the average price paid by the two was the same—$1.65.

Big carriers, operating large fleets of four engine transports purchased close to 5,000 new aircraft tires at an average cost of $130. At the same time they used more than 17,700 retreads, almost a four-to-one ratio over new purchases, and paid an average $33.60 per retread.

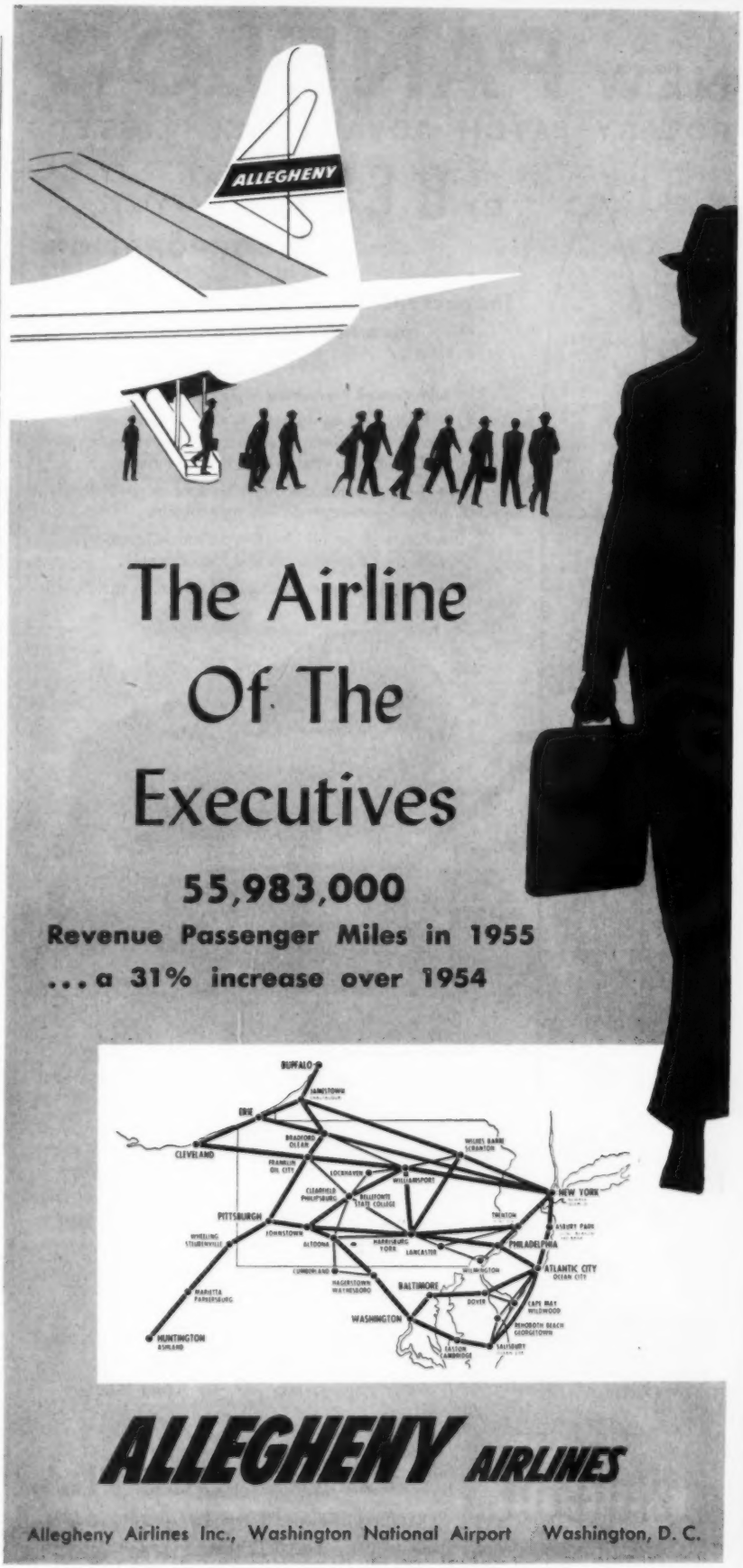
•**Volume buying** of more expensive tires brought unit costs for trunks almost down to the level of that paid by feeder lines for less-expensive DC-3 tires. Six local carriers bought only 465 new tires and 781 retreads (less than a 2-to-1 ratio) and paid an average $115 for new tires. Retread costs, although for smaller tires, were $45.60 on the average, $12 higher than the trunks.

This pattern varies for such items as electronic tubes and electrical wiring. Trunk airlines average $2.77 per tube buying close to 150,000. Locals, using less complex equipment and much lower volumes, paid only 37c less on the average for tubes.

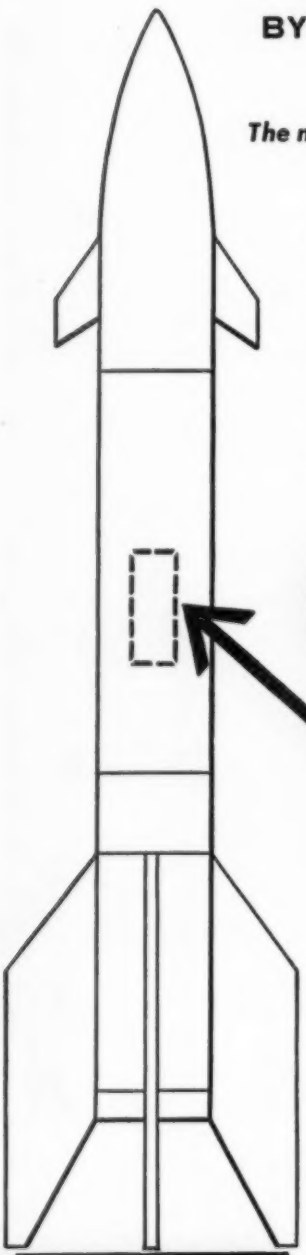
In electrical wiring procurement, the seven trunks bought over three million feet and paid less than 2½c per foot. Locals bought only 142,000 ft. and paid double per foot, or about 5c.

NAL Signs Fuel Contract

National Airlines signed contracts for delivery of 170 million gallons of aviation gasoline during the next three to five years. Shell Oil Co. will furnish 80 million gallons over five years at 19 refueling points. Cities Service Corp. will deliver 50 million gallons at Miami International Airport, 40 million at New York International, and 500,000, at West Palm Beach in next three years.



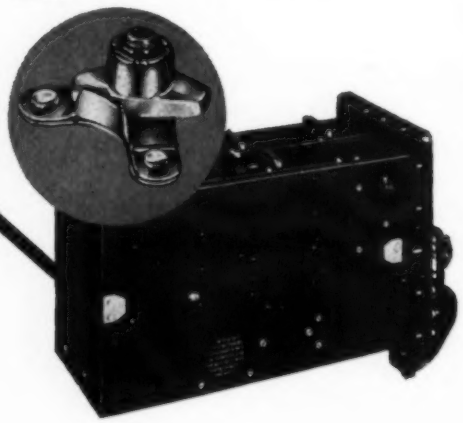
NEW PANELOC
ROTARY LATCH ADVANTAGES LISTED
BY BELL *Aircraft* CORPORATION



The next 135 words of this advertisement taken from Bell Engineers' letters

S. W. Esmond, Product Engineer:

- Electronic equipment shown was designed to use the PANELOC Rotary Latch at a great saving in space and weight, so vital to the aircraft engineer.
- Rotary Latch assembles to door or panel itself—no stud-to-receptacle line-up problem.
- Tests show no sheet separation—fastener locks with the effect of a nut and bolt assembly.
- Vibration tests also had no effect on the Rotary Latch.



F. P. Bassett, Project Engineer:

- Rotary Latch selected for use on cowl access doors on Bell's latest vertical-rising (VTOL) aircraft.
- The new PANELOC Rotary Latch is excellent for hinged doors and applications where maximum access and opening are important design considerations.
- Its simplicity, vibration resistance, ease of installation and cost are other factors that resulted in Bell's adoption of this new fastener.
- Now in use on fixed-wing aircraft, helicopters, missiles, electronic components.

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Airlines Report Salaries Of Top Executives

The following carrriers have filed with CAB Schedule E reports listing the 1955 salaries and other compensation of officers and directors:

Allegheny Airlines, Inc.—Leslie O. Barnes, pres. and dir., $22,499.92 salary (up $5,833.20), no bonus and indirect compensation; Everett K. Arnold, v.p. & secy., $10,799.84 salary (up $799.85), no bonus & indir.; David L. Miller, v.p.-traffic & sales dir., $10,799.84 (up $799.84), no bonus & indir.; Walter J. Short, v.p. & treas., $11,666.56 salary (up $1666.56), no bonus & indir.; Jean C. Langsdale, asst. secy. (resigned), $2,622.14 salary (down $977.86), no bonus & indir.

Persons other than directors, officers, and employes paid more than $10,000 for personal services were Hale Stimson, Russell & Nickerson, legal, $28,000.

Byers Airways, Inc.—Robert D. Byers, pres., $14,400 salary, $100 bonus & indir.; Gladys T. Byers, v.p., $2,300 salary, $100 bonus & indir.; Frank Jones, asst. secy., $8,600 salary (up $400), $100 bonus & indir.; Mildred Bettisworth, secy.-treas., $6,575 salary (down $950), $100 bonus & indir.

Colonial Airlines, Inc.—Branch T. Dykes, pres. & dir., $29,600 salary (up $667), $4,884* bonus & indir.; Thomas J. Dunnion, v.p., $18,200 salary (up $667), $2,161* bonus & indir.; L. Orville Cameron, v.p. & secy., $18,000 salary (up $667), $1,346* bonus & indir.; Carl W. Rach, v.p.-oper., $19,500 salary (up $747), $2,202* bonus & indir.; James E. Reinke, v.p.-traffic & sales, $14,000 salary (up $947), $871* bonus & indir.; Norman D. MacDonald, treas., $12,000 salary (up $667) $677 bonus & indir.; Thomas A. Campo, asst. treas., $8,500 salary (up $333), $443* bonus & indir.; Daniel S. Dunn, asst. secy., $7,600 salary (up $333), $311* bonus & indir.; John J. Murphy, dir. & chm. exec. comm., $12,000 (up $1,000), $1,021* bonus & indir.; Albert Green, dir., no salary, $1,000** bonus & indir.; Edmond M. Hanrahan, dir., no salary, $1,000** bonus & indir.; Francis Hartley, Jr., dir., no salary, $1,000** bonus & indir.; A. Charles Schwartz, dir., no salary, $900** bonus & indir.; Jos. V. Schields, dir., no salary, $1,000** bonus & indir.

Persons other than directors, officers and employes paid more than $10,000 for personal services were Sullivan, Donovan, Hanrahan, McGovern & Lane, N.Y.C., legal, 1953-55, $62,000; Frederic P. Kimball, Westport, Conn., consultant, $12,450, and Arthur Young & Co., public accountants, N.Y.C., $10,500.

**Accrual of proposed retirement benefit.*
***Directors fees.*

Northwest Airlines, Inc.—Donald W. Nyrop, pres. & chief exec. officer, $52,000 salary (up $38,422), no bonus & indir.; Malcolm S. Mackay, exec. v.p., $30,000 salary (up $737), no bonus & indir.; Frank C. Judd, v.p.-oper. & engineering, $25,000 salary, no bonus & indir.; James W. Mariner, v.p.-sales, $18,000 salary, no bonus & indir.; Linus C. Glotzbach, v.p.-personnel, $23,000 salary (up $1,000), no bonus & indir.; Lawrence B. Kinports, v.p.-Orient region (retired 9/30/55), $13,785 salary (down $3,254), no bonus & indir.; A. E. Floan, v.p. & secy., $22,000 salary (up $1,000), no bonus & indir.; Leonard S. Holstad, comptroller, $20,000 salary (up $295), no bonus & indir.; Wm. J. Eiden, treas., $20,000 salary (up $606), no bonus & indir.; A. D. Piepgras, asst. comptroller, $12,000 salary, no bonus & indir.; Donald H. Hardesty, asst. treas., $12,000 salary (up $2,020), no bonus & indir.; Frank J. Scott, asst. secy., $9,600 salary, no bonus & indir.; Dale Merrick, asst. v.p.-properties, $13,000 salary, no bonus & indir.; C. L. Stewart, asst. v.p.-plans, $13,250 salary (up $2,250), no bonus & indir.; P. L. Benscoter, v.p.-Orient region, $8,100 salary, no bonus & indir.; Croll Hunter, chm. bd., $50,000 salary, no bonus & indir.; James H. Binger, dir., $700 salary (up $200), no bonus & indir.; Morton H. Fry, dir., $1,200 salary (down $3,533), no bonus & indir.; Robert M. Hardy, dir., $900 salary (up $200), no bonus & indir.; Joseph T. Johnson, dir., $900 salary (down $5,200), no bonus & indir.; Alonzo Petteys, dir., $1,200 salary (down $200), no bonus & indir.; C. Frank Reavis, dir., $800 salary (down $1,059), no bonus & indir.; Albert G. Redpath, dir., $1,100 salary (down $100), no bonus & indir.; William Stern, dir., $10,800 salary (up $800), no bonus & indir.; Albert F. Tegen, dir., (resigned 12/30/55) $800 salary (down $3,433), no bonus & indir.

Ellis Air Lines—R. E. Ellis, pres., $14,400 salary, no bonus & indir.; G. A. Bodding, v.p., $13,200 salary, no bonus & indir.; N. T. Gerde, secy.-treas., $12,300 salary, no bonus & indir.; J. L. Sherman, v.p., $12,300 salary, no bonus & indir.; R. L. Elliott, dir., $11,700 salary, no bonus & indir.; W. A. Nebel, dir., $10,800 salary, no bonus & indir.; K. J. Vanderweele, dir., $8,100 salary, no bonus & indir.

Continental Air Lines, Inc.—Louis H. Mueller, chm. bd., no salary, $600 bonus & indir.; Robert F. Six, pres. & dir., $40,000 salary (up $5,000), no bonus & indir.; Joseph A. Uhl, v.p.-treas. & dir., $18,500 salary (up $1,500), no bonus & indir.; C. C. West, Jr., v.p. & Dir., $22,500 salary (up $3,000), no bonus & indir.; O. R. Haueter, v.p.-oper., $22,000 salary (up $1,500), no bonus & indir.; Lynn H. Dennis, v.p.-flight service, $12,356 salary (up $856), no bonus & indir.; Stanley O. Halberg, v.p.-pub. rel., $12,500 salary (up $500), no bonus & indir.; Harding L. Lawrence, v.p.-traffic & sales, $10,800 salary (up $10,800), no bonus & indir.; Charles H. Calhoun, v.p.-engr. & maint., $11,250 salary (up $11,250), no bonus & indir.; Harold B. Seifert, v.p.-operation adm., $2,021 salary (up $2,021), no bonus & indir.; S. B. Redmond, secy., $11,500 salary (up $500), no bonus & indir.; Paul K. Kriethe, Jr., asst. secy.; $8,368 salary (up $8,368), no bonus & indir.; Lawrence C. Ames, dir., no salary, $600 bonus & indir.; F L. Ehrman, dir., no salary, $200 bonus & indir.; Marco F. Hellman, dir., no salary, $400 bonus & indir.; Frank H. Ricketson, Jr., dir., no salary, $300 bonus & indir.; Thomas Roberts, dir., no salary, $100 bonus & indir.; Robert J. Smith, dir., no salary, $200 bonus & indir.

Persons other than directors, officers and employes paid more than $10,000 for personal services were C. Edward Leasure, Washington, D.C., legal service, $17,500, and Holland & Hart, Denver, Colo., $19,000.

Contracts

Recent contract awards announced by Commerce Dept. are listed below. Unless otherwise noted, contracts are with Air Force:

Convair Div., General Dynamics Corp., San Diego, Calif., $17,000,000, production of F-102 interceptors.

Hughes Aircraft Co., Culver City, Calif., $5,308,226, modification and repair of fire control systems and test equipment.

Sundstrand Machine Tool Co., Rockford, Ill., $4,675,545, transmission and governor assemblies and constant speed drives.

Contracts announced by companies:

Ryan Aeronautical Co., San Diego, Calif., $12.5 million, fuselage sections for Boeing 707 jet transports.

Chance Vought Aircraft, Dallas, Tex., $45 million, Navy contract for F8U-1 supersonic fighters.

Facilities

Hamilton Standard Div. of United Aircraft Corp. leased over 30,000 sq. ft. of floor space in St. Petersburg, Fla., for engineering and development of specialized aircraft equipment. Production facilities are not planned.

Bendix Aviation Corp. is building facilities at Palmdale, Calif. Company's Utica division is putting up a 2,000-sq. ft. plant to service and test combustion starters and air turbine accessories. Bendix Products Division will house shop and test facilities for fuel metering and landing gear equipment.

Battelle Memorial Institute has established an electronic reliability division at its Columbus, O., laboratories, to meet increasing demands for research on electronic components and systems.

Liquidometer Corp., of Long Island City, N. Y., starts construction in May on a new Los Angeles engineering and sales office.

Beckman Instruments Inc. will move its Arga division this year from South Pasadena, Calif., to Costa Mesa, Calif. The Helipot division broke ground last month for a new $2-million plant in nearby Newport Beach.

Sikorsky Aircraft has transferred executive offices from Bridgeport to the firm's new plant in nearby Stratford, Conn.

Beckman Instruments Inc. has broken ground in Newport Beach, Calif., for a $2 million plant for its Helipot Division, manufacturer of precision electronic components. Upon completion late this year, the plant will employ 2,000.

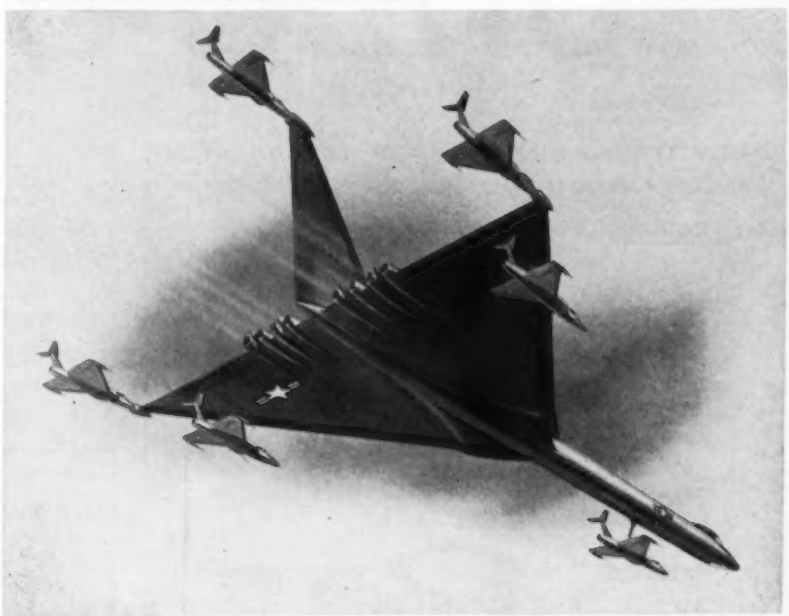
Airline Flight Crew Employment

Carrier	Pilots & Copilots	Flight Engineers	Cabin Attendants	Total	Avg. Annual Utilization*
AAA	95	...	44	139	...
AA	1393	433	1069	2895	748
BAL	50	...	28	78	778
BNF	341	28	193	562	946
CAI	99	...	60	159	...
CAL	206	9	109	324	840
CAP	575	**	335	910	...
CBA	7	...	...	7	...
CEN	52	...	28	80	742
DAL	489	**	253	742	757
EAL					
FAL	89	...	50	139	...
HAL	55	...	23	78	668
LCA	45	...	23	68	792
MOH	76	...	36	112	...
NAL	297	88	229	614	774
NEA	124	...	58	182	...
NOR	120	...	60	180	...
NWA	416	106	335	857	...
OZA	92	...	42	134	...
PAA-ATL	677	281	413	1371	...
-LAD	424	105	324	853	...
-PAC	320	110	261	691	...
PAI	120	...	55	175	900
Panagra	107	...	81	188	...
SOU	58	...	30	88	908
SWA	62	...	30	92	...
TPA	28	...	12	40	765
TTA	95	...	48	143	592
TWA	1297	465	994	2756	...
UAL	1341	450	947	2738	696
WAL	248	42	157	447	...
WCA	72	...	32	104	736
TOTAL	9470	2117	6359	17946	
Helicopter Operations					
HAS	9	...	...	9	706
NYA	13	...	...	13	696

** Annual utilization per pilot. ** Use pilot engineers.*
Navigators are used by CAI (5), TWA (85) and UAL (22).
Radio operators by TWA (102).

Source: American Aviation Survey

Future A-Powered Bomber?



This concept of an atomic powered bomber towing its own fighter escort was advanced last week by Northrop Aircraft's A-specialist Lee. A. Ohlinger at New York Society of Automotive Engineers' meeting. Bomber would fly below Mach 1 during tow, then release protective fighters and operate in supersonic range under enemy attack.

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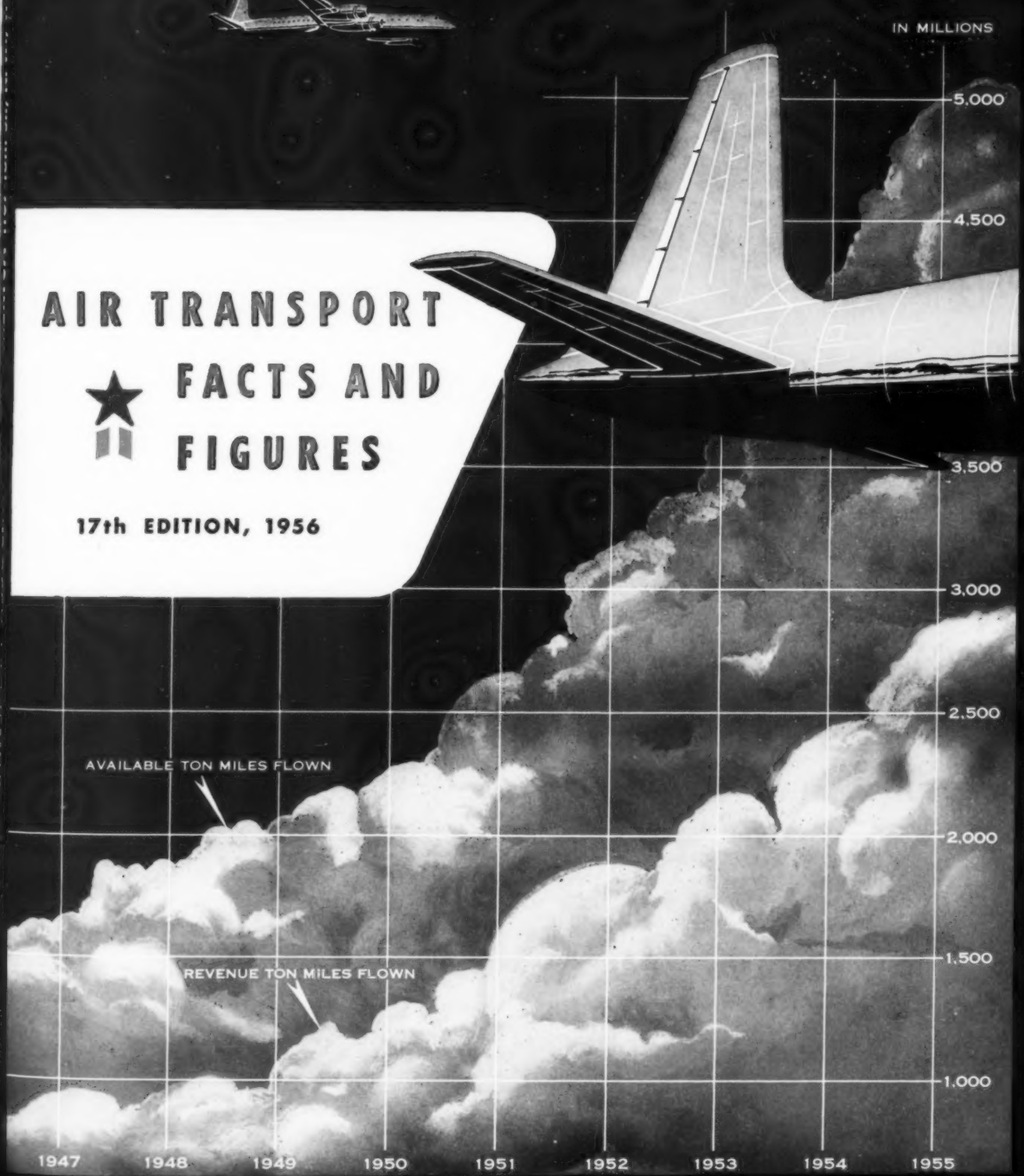
Esso

INTERNATIONAL AVIATION PETROLEUM SERVICE

a decade of **POST WAR SERVICE**

AIR TRANSPORT FACTS AND FIGURES

17th EDITION, 1956



The President's Message

The year 1955 marked for the scheduled airlines of the United States the completion of a decade of service since the end of World War II. During that decade, the American-Flag airlines evolved into the most competitive, the most efficient and the most useful air transport system in the world.

That progress was achieved by private enterprise operating under a Federal law which obligates scheduled air transport to the public service. By law as by policy, the aim of the certificated, scheduled airlines of the U. S. is a comprehensive, flexible air service for the country as a whole.

As general measures of increased usefulness, it can be noted that the industry offered 4 times as many available ton miles in 1955 as in 1946; that air service was extended to many communities which had never previously received its benefits; that new fleets of airliners were introduced; and that the level of the average air fare nevertheless stood in 1955 just about where it stood in 1938. In terms of 1938 dollars, air fares actually have been cut by 60 per cent.

All branches of the family of the scheduled airlines contributed during the decade to the growing usefulness of scheduled air transport:

- The country's great domestic system undertook two equipment revolutions, underwent drastic route reshufflings, developed greatly increased competition, and emerged virtually subsidy free, despite financial crises shortly after World War II.
- The international and overseas operators, competing with one another as well as with heavily subsidized foreign-flag systems, webbed a war-torn world with air service; undertook two equipment revolutions; drastically cut international air fares; and emerged with subsidy amounting to only 3.6 per cent of gross revenues in 1955 as distinct from an estimated 13.8 per cent in 1951.
- The whole system of local service airlines came into being to bring a comprehensive system of regularly scheduled air service to America's important intermediate cities for the first time.
- The Alaskan and Territorial airlines proved to be indispensable to communities whose existence would have been threatened by lack of transportation or whose progress would have been retarded by dependence upon slow surface transportation.
- The fledging helicopter operators came into being to begin the fruitful experiment in regular helicopter schedules in the metropolitan areas of New York, Chicago and Los Angeles.

In 1955, two developments were particularly significant for the industry, and for the country which it serves:

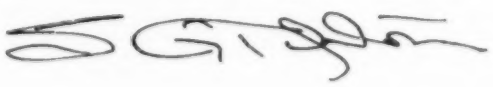
- Congress awarded permanent certification to the local service airlines.
- The domestic trunkline and international operators committed themselves to spend at least $1.3 billion on new equipment, including jets. On some routes, airliners powered by propjet engines were actually placed in service during that year.

The progress is the last decade has been impressive; far greater progress is expected in the years ahead. But problems as well as opportunities lie ahead.

One problem is air traffic control. The airline are only one user of the country's vanishing air space. But they share with other users the concern that today's methods of air traffic control will not be suitable for the numbers and speed of tomorrow's aircraft. However, the problem can be solved. The country has the ability to provide an air traffic control system adequate for its future needs.

Another problem concerns equality of regulation. The country's air service has been developed under a method of close regulation as to the fitness, willingness and ability of individual companies. The standards for authorizing routes and services have been the standards of public convenience and necessity rather than private gain. The public should be made aware that efforts to subvert the principles of regulated competition—upon which future progress depends—are being made.

Granted a stable regulatory climate, what lies ahead is a transportation revolution for the United States. Improvements in short-haul as in long-haul services will bring about new and better patterns of living for the American people.



a decade of POST WAR SERVICE

This index covers material demonstrating the increasing use of U. S. scheduled air transportation in the post war years. Revised data filed by the scheduled air transportation in the post war years. Revised data filed by the scheduled air carriers with the Civil Aeronautics Board and the records of the Interstate Commerce Commission served as the major sources of the statistics.

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Definition of Terms

Passenger Miles and Ton Miles

AVAILABLE SEAT MILES FLOWN. Total seat miles available for sale in scheduled service.

AVAILABLE TON MILES. Total ton miles of lift capacity available for sale in scheduled and charter service.

CHARTER FLIGHT. Transportation of passengers or property on other than scheduled and designated extra section flights.

EXPRESS TON MILE. A ton of express flown one mile.

FREIGHT TON MILE. A ton of freight flown one mile.

PASSENGER MILE. One passenger flown one mile.

PASSENGER LOAD FACTOR. The percentage of available seat miles actually sold in scheduled service.

PASSENGER TON MILES. Passenger miles converted to ton miles. (See definition of revenue ton miles.)

REVENUE PASSENGER MILES. The number of fare paying passengers flown times the length of trip in miles. This is the amount of available seat miles sold.

REVENUE PLANE MILES. Aircraft miles flown in scheduled service.

REVENUE TON MILES. The ton miles sold in scheduled and charter service. In the construction of this traffic measure passenger miles are converted to ton miles on the basis of about 10 to 1. That is, ten passengers with allowable free baggage are accepted as equalling one ton.

SEAT MILE. One passenger seat, filled or unfilled, flown one mile.

TON MILE LOAD FACTOR. Percentage of available ton miles sold in scheduled and charter service.

U. S. MAIL TON MILE. A ton of mail flown one mile. The statistic includes priority air letter mail and air parcel post. Since the beginning of the experiment on flying first-class (three-cent) mail by air, such non priority mail has also been included in U. S. Mail Ton Miles.

Revenues and Profit and Loss

EXPRESS REVENUE. Revenues accrued from the carriage of express.

FREIGHT REVENUE. Revenues accrued from the carriage of freight.

INCOME TAXES. Federal income taxes.

NET INCOME BEFORE TAXES. The net income to the business from all transactions. In addition to airline net operating income this includes such items as net profit from the sale of equipment, proceeds from the ownership or sale of investments, revenues of separately operated divisions, revenue from the rental or contractual operation of aircraft, and profit or loss on the exchange of foreign currency.

NET OPERATING INCOME. The total operating revenue from air transportation services less the operating expenses (see definition of Operating Expenses). Net Operating Income is before taxes and interest charges and does not include the nonoperating items in Net Income Taxes (see above).

NET PROFIT OR LOSS. Net income after Federal Income taxes—the amount available for dividends or investment in the business. This figure is subject to change because of the later adjustment of some accounting transactions and through revision of mail rates and subsidy by regulatory action.

OPERATING EXPENSES. The expenses incurred in the conduct of the business except for such items as debt financing and other non-operating items identified above in Net Income Before Income Taxes.

OTHER REVENUE. All other revenues, including excess baggage, chartered services, foreign mail, penalties for failure to cancel reservations, service charges on non-revenue transportation of employees and special services such as photography and crop dusting.

PASSENGER REVENUES. Passenger revenues from scheduled operations.

PUBLIC SERVICE REVENUES. Payments by the Federal Government to insure air service to communities in the United States and its territories which could not otherwise afford it; to maintain essential international air routes which are not yet self-supporting; and to develop helicopter service.

U. S. MAIL REVENUE. Service revenue for the transportation of mail. This is the amount paid by the Post Office to purchase air transportation for mail, and is not subsidy.

COMMERCE

Under the system of regulated competition, established by the Civil Aeronautics Act of 1938, the scheduled airlines of the United States have provided the country with the most competitive, the most efficient and the most useful airline system in the world.

Here are some of the measurements of the industry's expanded usefulness to the commerce of the country since 1938:

> The number of certificated airlines has risen from 22 to 56 and the number of employees from 13,300 to more than 118,000;
>
> the number of passengers from 1,526,000 to more than 41,623,000.

In terms of passenger miles, the domestic and international scheduled airlines increased from 533,052,000 in 1938 to 24,463,158,000 in 1955, an almost phenomenal rise of 4,489 per cent.

There were 284 daily schedules available in 1938, and more than seven times that number in 1955. Speeds of available equipment increased to as much as 360 miles an hour in 1955 as against 200 in 1946 and 180 in 1939. Range of equipment has also increased. Plans for the industry to put still faster planes in service make news almost daily.

A proof of the value the American public has placed on modern air transportation since World War II is that it has increased its spending on airline travel at a greater average yearly rate—18 per cent annually—than it has on any other type of personal spending.

Today scheduled air transportation is offering a post-war luxury service at pre-war average fare levels, which are still declining despite rising costs (in terms of 1939 dollars, it can be said that fares have been cut 60 per cent). In fact, domestic air coach and air tourist fares are lower than 1939 fares, although today's air coach and air tourist services are superior to 1939's first-class services. International air fares in 1955 were down by about 21 per cent in comparison with 1939.

Comparing 1955 with 1954, scheduled air transportation alone was responsible for about a 3 per cent increase in the domestic intercity passenger traffic of all commercial transportation facilities in 1955. Domestic airline passenger traffic in 1955 increased about 3.2 billion revenue passenger miles over 1954 while the surface carrier figures went down about 1.8 billion.

For the entire industry—domestic trunklines, local service lines, international carriers, territorial airlines, helicopter services and the Alaskan Carriers—revenue passenger-miles went up from 20,605,058,000 in 1954 to 24,338,000,000 in 1955, a gain of 18.1 per cent.

At the same time, passenger revenues for the industry rose from $1,166,554,000 in 1954 to $1,356,435,000 in 1955, an increase of 16.3 per cent. Public service revenues, or subsidy, on the other hand, dropped about 42 per cent from $66,233,000 in 1954 to $38,407,000 in 1955, or 2.4 per cent of total revenues.

Total revenues for the industry went up from $1,420,847,000 in 1954 to $1,610,557,000 in 1955 for a gain of 13.35 per cent.

Mail ton miles recorded for the industry went up from 118,293,000 in 1954 to 142,209,000 in 1955, an increase of about 19 per cent, while foreign mail ton-miles rose nearly 7 per cent from 7,338,000 in 1954 to 7,842,000 in 1955.

Express ton-miles for the entire industry totaled 51,075,000 in 1955, up 24 per cent from the 41,175,000 total in 1954, while the freight ton-mile total rose from 236,623,000 in 1954 to 280,938,000 in 1955 for an increase of 18.7 per cent.

During 1955, the industry started the biggest equipment drive in its history. Positive orders and public statements of intention to order included 135 pure jet transport planes at a total cost of $761,300,000; 135 turbo-prop airplanes—aircraft with jet engines turning propellors—at a total cost of $265,000,000 and 55 piston-engine airplanes at a total cost of $137,300,000.

In addition, announced equipment-buying plans totaling another $146,000,000 will probably include orders for all three types of airplanes. The total of $1,309,600,000 does not include an option held on 30 additional turbo-prop airplanes.

DOMESTIC TRUNKLINES

The domestic trunklines, which are virtually subsidy-free, set new records in 1955. Revenue passenger miles were up nearly 18 per cent; gains of 25.2 per cent in coach traffic and 14.5 per cent in first class. Revenue ton miles gained 20 per cent; express ton miles increased 25 per cent and freight ton-miles 22 per cent. Mail traffic was up almost 9 per cent.

Total revenues were up, too, with a gain of 16 per cent which for the first time placed the domestic trunklines total operating revenue well above the billion dollar mark. Passenger revenues alone showed a gain of more than 16 per cent and accounted for almost 97 per cent of the total revenues. Public service revenues dropped more than 25 per cent. (Most of the domestic trunklines are subsidy free, with the result that subsidy for the trunklines as a whole amounted to only one quarter of one per cent of total revenues.)

INTERNATIONAL

During the 12-month period ending June, 1955, American-Flag airlines recorded gains at 24.3 per cent in the number of passengers leaving the country and 21.2 per cent in incoming passengers, while foreign-flag airlines gained 15.9 per cent in passengers departing from the U. S. and 8.9 per cent in passengers arriving in the United States. June was the first month in which more people flew to Europe than went by ocean vessels.

During the 12-month period ending in June, 1955, a total of 1,177,546 people arrived in this country via air, of which 808,999 came via American-Flag airlines and 368,547 used foreign-flag airlines. In these same twelve months, 1,028,264 passengers left the United States by air, 698,523 using American-Flag airlines and 329,741 flying under a foreign flag.

In that period coach or tourist-class service continued to gain until it outnumbered first-class traffic approximately two to one.

During 1955 American-Flag airlines ordered jet transports from Boeing and Douglas which are presently scheduled for international operations in 1959.

Subsidy payments dropped from $28,500,000 to $7,600,000, or 73 per cent. The latter figure is 2% of the 1955 total revenues.

LOCAL SERVICE

During 1955, Congress, recognizing the value of the local service airlines in the national transportation picture, directed the CAB award them permanent certificates.

The local service airlines have increased their revenue passenger miles more than 77 times since 1946, their first full year of operation. In 1946 they carried 25,000 passengers; in 1955 the number reached almost 3 million.

In the five-year period ending with 1955, the local service airlines more than tripled their revenue passenger miles, while increasing their passenger revenues four times and their total commercial revenues more than three times. Their percentage of public service revenues to total revenues has also declined; in 1954 public service revenues amounted to 57 per cent of their income. In 1955 the corresponding figure was approximately 37 per cent.

HELICOPTER CARRIERS

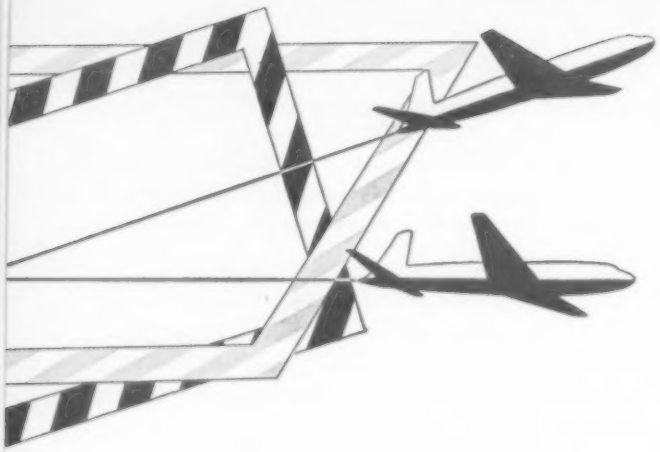
The helicopter airlines in the five years ending with 1955 have more than doubled the available ton miles of service offered. They increased their revenue passenger miles almost 3½ times in 1955, compared with 1954. Their freight ton miles in this same period showed an increase of 26 per cent and their express ton miles rose more than 167 per cent. Total revenues were up 12.3 per cent.

ALASKAN CARRIERS

The Alaskan carriers showed increases in all forms of traffic, with revenue passenger miles up 26.9 per cent, mail ton miles up 10.8 per cent and combined express and freight ton miles up 21.7 per cent. Total revenues were up almost 15 per cent.

TERRITORIAL AIRLINES

The territorial airlines increased their revenue passenger miles in 1955 over 1954 7.4 per cent; their mail ton miles 5.3 per cent and despite a drop in freight ton miles their total revenue ton miles were up 8.4 per cent. Total revenues were up 13.8 per cent.



MAIL

Back in the days when commercial scheduled air service was born, air mail was the major source of revenue for the country's young airlines. Scheduled air service then was in fact designed for the sole purpose of speeding the mails.

Today, however, payments for carrying the mail are only 4.5 per cent of the revenues for the entire scheduled airline industry. In addition, air mail today is a source of revenue for the Post Office.

The total of postal revenues taken in by the Government on domestic air mail services fiscal 1955 was $142,571,000. Of that amount, the Post Office paid the airlines $33,719,567.

In fiscal year 1955 it is estimated that domestic air mail showed a return of $20,268,000 or 14.2 per cent on a gross revenue of $143,000,000. International air mail had a return of $12,161,000.

Over the past four years, the Post Office had a return of $47,598,000 on domestic air mail, or 12.4 per cent on a gross of $383,413,000. International air mail in the same period showed a return to the Post Office of $26,800,000.

In addition to carrying air mail, the airlines and the Post Office are now conducting an experiment in carrying three-cent mail by air on a space-available basis whenever carriage by air saves time over and costs no more than surface transportation.

At the present time about 4 million pieces of first-class mail are moving every day on a space available basis by air. Under the first-class mail experiment, a part of the national transportation evolution now going on in the United States, about 21,000 tons of three-cent letter mail is being moved annually or about 6 per cent of the 17 billion non-local first-class mail handled yearly. The Post Office has estimated that the delivery of this mail is as much as 48 hours faster than when carried by surface transportation.

While the experiment is succeeding, the airlines are not certain that they are being compensated adequately for the service (in the first twelve months of the experiment they received $1,830,000 for carrying the mail between the points affected while returning $29,500,000 to the Post Office). But the main point is that the experiment is proving that the lines have the airlift capacity to provide the service.

This new service does not infringe upon six-cent air mail service—a superior service that gets special treatment from the moment of mailing.

AIR NAVIGATION AND TRAFFIC CONTROL

The people of the United States are running out of one of their most vital resources—the airspace. The sky, which once seemed to be limitless, is now in short supply; it has become a critical commodity in this day of ever-increasing numbers of air transports, military aircraft and numerous classes of business and private aircraft, many flying at ever-increasing speeds.

But the demands for airspace do not stop with the multiple types of aircraft using it. The Army requires airspace to conduct artillery firing, the television industry seeks more airspace for transmitting towers, and the Atomic Energy Commission must have its share of the airspace for vital experimental and test purposes.

The problem resulting is how to control the users of the airspace so that each will have his fair share.

Today's method of controlling air traffic is not only outmoded, but it will be seriously inadequate tomorrow. No system yet exists which will adequately control tomorrow's planes in tomorrow's numbers flying at tomorrow's speeds. The attack on this problem should be two-pronged. First, steps should be taken to install at a greatly accelerated pace the air traffic control tools already in existence. Radar is one such tool for bolstering the present safe but entirely inadequate system. And simultaneously, steps should be taken to begin the development of a bold, new revolutionary system for the future. The end product of the new system should be fully automatic air traffic control, which has the feature of being gradually integrated with, and also compatible with, our present system.

The Federal Government at both the Congressional and Executive level recognizes the nation's air traffic control needs. An aviation subcommittee of the

Senate Committee on Foreign and Interstate Commerce, known as the Monroney Committee, has undertaken a study which includes an examination of the nation's current air traffic status and future requirements. The Bureau of the Budget has completed a report on the subject and President Eisenhower has appointed Edward Peck Curtis as a Special Assistant for Aviation Facilities Planning to head an attack on the problem of an air traffic control system suited to the country's future needs.

NATIONAL DEFENSE

One of the principal contributions of the scheduled airlines is in the large, modern fleet they maintain in being. That fleet contains aircraft essential to the national defense and which, if they were not provided by the airlines, would have to be built and maintained on a "stand-by" basis by the taxpayers.

The large commitments for jet airliners planned to start to go into service beginning in 1958 are thus as significant to the defense as to the commerce of the United States. The jetliners will represent defense contributions by airlines which not only, as a group, are free of subsidy but which out of their own funds are able to create an active fleet reserve for the military.

Apart from the future contribution represented by the jetliners, the scheduled airlines today stand ready to aid in any national emergency with the largest Civil Reserve Air Fleet (CRAF) the world has ever known—a fleet composed of more than 45 per cent of the air transport industry's biggest, fastest and latest airliners now flying our domestic and international routes. This airlift capacity costs the government nothing, for the contractual arrangement involves no charge to the government unless there is an emergency.

The CRAF program is based on experience and know-how and proven performance born of lessons learned in World War II, the Berlin Airlift and Korea. The CRAF fleet, available on 48-hour notice, is the result of a joint plan worked out by the Department of Defense, the Department of Commerce and the operators of our civilian air transportation system. The fleet, which represents initial investments estimated in the neighborhood of $400,000,000 in aircraft equipment, would cost the taxpayers $300,000,000 annually if it were maintained and operated by the government on a "stand-by" basis.

The present fleet has an airlift capacity estimated at 566,000 available ton-miles an hour. But according to the Defense Air Transport Administration, which is charged with allocating the aircraft on the basis of the proposed 1956-57 program, the above figures will be revised upward to around 797,000 ton-miles an hour by including more of the bigger and faster planes.

In addition, the CRAF program is to include a War Air Service Pattern for the remaining civil airliner fleet, which is now being worked out to speed the flow of civilian traffic vital to the national defense.

As to their peacetime usefulness to the military, the scheduled airlines in 1955 provided over 843,900,000 passenger-miles of transportation to the various military agencies for their official travel. Through the Military Bureau of the Air Transport Association in Washington, D. C. and its offices throughout the country, the scheduled airlines are constantly serving peacetime requirements of the military departments.

During 1955, by the use of air travel, the Department of Defense realized a saving of 20,165,301 man-hours of productive time of their personnel. Converting the saving to dollars (in terms of per diem payable and the base pay of a private), the man-hour saving represented a net gain to the U. S. Government of $9.8 million.

The scheduled airlines have established over 50 offices at military installations throughout the country called Joint Airlines Military Traffic Offices (JAMTO's). These offices assist in making arrangements for the prompt and efficient movement of personnel and cargo. Over 30,000 military personnel per month have availed themselves of these services for their official and personal travel requirements.

AVAILABLE SERVICE AND UTILIZATION

U. S. Scheduled Airline Industry, 1947-1955 (In Millions)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Domestic Trunk Airlines									
Available Ton Miles Flown	1,209.7	1,357.9	1,517.4	1,684.1	1,974.0	2,399.3	2,893.3	3,314.1	3,882.7
Revenue Ton Miles Flown	689.1	706.2	809.0	963.2	1,204.7	1,413.5	1,644.3	1,862.0	2,190.6
Ton Mile Load Factor (%)	56.97	52.01	53.31	57.20	61.02	58.91	56.83	56.18	56.42
Available Seat Miles Flown	9,152.4	9,980.2	11,117.7	12,385.6	14,672	18,068.1	22,114.8	25,729.9	29,978.6
Revenue Passenger Miles Flown	6,016.3	5,822.4	6,570.7	7,766.0	10,210.7	12,120.8	14,297.6	16,288.4	19,205.2
Passenger Load Factor (%)	65.73	58.34	59.10	62.70	69.59	67.08	64.65	63.31	64.06
Revenue Plane Miles Flown	311.9	316.3	323.2	327.1	362.5	411.4	467.0	497.2	563.1
Local Service Airlines									
Available Ton Miles Flown	14.9	31.5	46.4	62.4	81.5	96.2	109.3	115.2	121.9
Revenue Ton Miles Flown	4.7	9.1	14.3	20.9	31.6	36.1	40.7	48.4	55.0
Ton Mile Load Factor (%)	31.87	28.92	30.93	33.51	38.79	37.53	37.28	41.65	45.12
Available Seat Miles Flown	155.5	323.9	477.9	599.2	774.7	905.4	1,013.6	1,092.9	1,161.3
Revenue Passenger Miles Flown	46.4	87.9	134.7	188.8	289.6	339.2	390.9	461.2	523.3
Passenger Load Factor (%)	29.85	27.14	28.18	31.51	37.39	37.46	38.56	42.20	45.06
Revenue Plane Miles Flown	10.1	18.0	24.5	33.0	38.0	41.5	45.6	48.7	51.0
Territorial Airlines									
Available Ton Miles Flown	8.3	9.1	10.1	10.9	13.8	14.2	15.9	15.7	16.1
Revenue Ton Miles Flown	4.9	5.2	5.3	5.8	6.6	7.0	7.4	7.7	8.8
Ton Mile Load Factor (%)	59.91	57.12	52.47	52.75	47.86	49.49	46.70	49.30	54.27
Available Seat Miles Flown	65.9	81.0	91.3	100.1	119.0	124.1	134.6	134.5	134.7
Revenue Passenger Miles Flown	46.8	52.9	52.6	57.7	65.8	67.9	71.8	72.7	78.1
Passenger Load Factor (%)	71.10	65.28	57.19	57.66	55.27	54.72	53.37	54.04	57.99
Revenue Plane Miles Flown	3.1	3.6	4.0	4.3	5.0	5.4	4.9	4.7	4.6
Helicopter Airlines *(in thousands)*									
Available Ton Miles Flown	14	108	142	189	185	181	350	403	438
Revenue Ton Miles Flown	3	28	46	63	71	75	129	152	194
Ton Mile Load Factor (%)	18.43	25.93	32.39	33.33	38.38	41.44	36.86	37.71	44.35
Available Seat Miles Flown	.....	.....	.....	.....	.....	.....	191	716	1,708
Revenue Passenger Miles Flown	.....	.....	.....	.....	.....	.....	26	183	628
Passenger Load Factor (%)	.....	.....	.....	.....	.....	.....	13.61	25.56	36.77
Revenue Plane Miles Flown	37	284	412	668	619	631	1,006	1,071	1,152
International and Overseas Airlines									
Available Ton Miles Flown	425.8	480.8	540.3	554.2	608.4	693.7	760.5	856.1	983.1
Revenue Ton Miles Flown	243.7	273.5	300.4	325.4	377.8	426.3	466.8	527.4	623.6
Ton Mile Load Factor (%)	57.24	56.89	55.60	58.71	62.09	61.45	62.38	61.60	63.43
Available Seat Miles Flown	2,924.3	3,292.3	3,624.7	3,695.5	4,361.4	4,848.8	5,462.2	6,284.9	7,015.9
Revenue Passenger Miles Flown	1,810.0	1,888.9	2,054.0	2,206.4	2,599.0	3,019.8	3,381.1	3,743.3	4,410.4
Passenger Load Factor (%)	61.90	57.37	56.67	59.71	59.59	62.28	61.90	59.56	62.86
Revenue Plane Miles Flown	86.5	98.1	104.3	93.8	97.4	103.4	109.6	116.1	130.8

AVAILABLE SERVICE AND UTILIZATION *(continued)*

U. S. Scheduled Airline Industry, 1947-1955 (In Millions)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Alaskan Airlines									
Available Ton Miles Flown		20.1	20.3	19.7	15.8	26.7	34.1	34.5	45.6
Revenue Ton Miles Flown		12.8	11.1	10.1	8.5	14.4	19.5	19.4	29.0
Ton Mile Load Factor (%)	Not	63.64	54.76	50.93	54.16	53.89	57.23	56.37	63.63
Available Seat Miles Flown	Available	42.6	38.9	54.0	82.4	168.9	209.2	206.3	233.9
Revenue Passenger Miles Flown		19.6	15.4	22.4	36.5	71.2	92.4	86.9	110.4
Passenger Load Factor (%)		46.10	39.64	41.60	44.26	42.18	44.15	42.15	47.20
Revenue Plane Miles Flown		4.7	3.9	5.4	6.9	9.3	10.4	9.6	10.5
Total Scheduled Airline Industry									
Available Ton Miles Flown	1,658.7	1,899.5	2,134.6	2,331.5	2,693.7	3,230.3	3,813.5	4,336.0	5,049.8
Revenue Ton Miles Flown	942.4	1,006.8	1,140.2	1,325.4	1,629.2	1,897.3	2,178.9	2,465.0	2,907.2
Ton Mile Load Factor (%)	56.82	53.00	53.41	56.85	60.48	58.73	57.14	56.85	57.57
Available Seat Miles Flown	12,298.1	13,720.0	15,350.5	16,834.4	20,009.5	24,115.3	28,934.6	33,449.2	38,526.1
Revenue Passenger Miles Flown	7,919.5	7,871.7	8,827.4	10,241.3	13,201.6	15,618.9	18,233.8	20,652.7	24,328.0
Passenger Load Factor (%)	64.40	57.37	57.51	60.84	65.98	64.77	63.02	61.74	63.15
Revenue Plane Miles Flown	411.6	441.0	460.3	464.3	510.4	571.6	638.5	677.3	761.2

REVENUE TON-MILE TRAFFIC CARRIED

by U. S. Scheduled Airline Industry, 1947-1955 (In Thousands of Revenue Ton-Miles)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Domestic Trunk Airlines									
Passenger	579,859	558,680	632,014	747,558	982,642	1,167,556	1,377,728	1,572,594	1,855,106
Freight	35,214	70,438	94,190	112,861	100,581	117,128	131,778	144,514	173,988
U. S. Mail	32,879	37,510	40,874	46,315	62,932	68,296	71,725	80,201	85,996
Express	28,533	29,769	27,329	36,538	40,260	40,375	42,514	40,090	49,585
Charter Flights	5,774	3,158	7,483	8,203	8,576	8,593	6,874	8,317	6,928
All Other[1]	6,875	6,657	7,102	11,782	9,680	11,512	13,706	16,285	19,043
Total	689,134	706,212	808,992	963,257	1,204,671	1,413,460	1,644,325	1,862,001	2,190,646
Local Service Airlines									
Passenger	4,316	8,184	12,908	18,242	27,904	32,373	36,767	43,505	49,320
Freight	62	265	436	696	920	1,116	1,179	1,188	1,359
U. S. Mail	165	334	428	566	787	912	1,000	1,255	1,257
Express	118	190	320	623	908	894	954	1,076	1,403
Charter Flights	59	90	194	653	961	653	649	1,108	1,404
All Other[1]	18	39	60	118	132	168	198	232	245
Total	4,738	9,102	14,346	20,898	31,612	36,116	40,747	48,364	54,988

[1] All other includes excess baggage and foreign mail ton miles in international figures.

REVENUE TON-MILE TRAFFIC CARRIED *(continued)*

by U. S. Scheduled Airline Industry, 1947-1955 (In Thousands of Revenue Ton-Miles)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Territorial Airlines									
Passenger	3,839	4,309	4,309	4,680	5,234	5,354	5,806	5,947	6,600
Freight	636	581	618	529	855	1,258	1,503	1,657	1,647
U. S. Mail	43	53	70	65	59	50	57	58	59
Express	116	134	124	119	100	55	.....	.....	.....
Charter Flights	184	39	123	303	283	272	27	45	436
All Other[1]	68	68	66	55	50	49	46	36	20
Total	4,886	5,184	5,310	5,753	6,581	7,038	7,439	7,743	8,762
Helicopter Airlines									
Passenger	.....	.....	.....	.....	.....	.....	2	17	58
Freight	.....	.....	.....	.....	.....	.....	2	5	5
U. S. Mail	3	28	46	63	71	75	123	115	97
Express	.....	.....	.....	.....	.....	.....	.....	13	32
All Other[1]	.....	.....	.....	.....	.....	.....	2	2	1
Total	3	28	46	63	71	75	129	152	193
International and Overseas Airlines									
Passenger	184,303	194,399	211,734	228,114	266,989	310,716	345,383	379,801	442,880
Freight	2,110	4,012	6,714	16,050	71,004	72,346	74,427	82,101	90,710
U. S. Mail	12,756	17,203	19,772	21,188	21,875	22,068	24,466	35,321	52,409
Express	30,786	41,581	49,444	44,513	289	281	219	217	243
Charter Flights	5,275	7,990	3,233	5,730	6,724	7,846	7,700	13,790	19,701
All Other[1]	8,483	8,314	9,515	9,825	10,903	13,051	14,583	16,126	17,652
Total	243,713	273,499	300,412	325,420	377,784	426,308	466,778	527,356	623,595
Alaskan Airlines									
Passenger		1,962	1,543	2,245	3,743	7,490	9,838	9,139	11,753
Freight		1,027	618	882	1,763	4,252	5,908	5,998	7,302
U. S. Mail	Not	281	479	741	970	1,591	1,987	2,058	2,280
Charter Flights	Available	9,509	8,449	6,095	2,016	955	1,640	2,086	7,556
All Other[1]		40	27	90	51	99	114	114	150
Total		12,819	11,116	10,053	8,543	14,387	19,487	19,395	29,041
Total Scheduled Airlines Industry									
Passenger	772,317	767,534	862,508	1,000,839	1,286,512	1,523,489	1,775,524	2,011,003	2,365,717
Freight	38,022	76,323	102,576	131,018	175,123	196,100	214,797	235,463	275,011
U. S. Mail	45,846	55,409	61,669	68,938	86,694	92,992	99,358	119,008	142,098
Express	59,553	71,674	77,217	81,793	41,557	41,605	43,687	41,396	51,263
Charter Flights	11,292	20,786	19,482	20,985	18,560	18,319	16,890	25,346	36,025
All Other[1]	15,444	15,118	16,770	21,870	20,816	24,879	28,649	32,795	37,111
Total	942,474	1,006,844	1,140,222	1,325,443	1,629,262	1,897,384	2,178,905	2,465,011	2,907,225

[1] All other includes excess baggage and foreign mail ton miles in international figures.

OPERATING REVENUES

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Domestic Trunk Airlines									
Passenger	$303,194	334,736	378,113	430,098	570,288	671,257	775,782	872,834	1,021,848
Freight	$ 8,358	13,825	18,323	21,698	21,030	25,529	29,341	33,008	39,574
U. S. Mail	$ 23,326	47,838	45,031	46,311	37,040	35,910	37,083	37,310	30,136
Express	$ 10,530	9,964	8,957	12,569	14,706	15,853	16,829	15,106	19,401
Other	$ 7,082	6,990	9,359	13,433	15,457	19,466	19,758	19,956	22,330
Total	$352,490	413,353	459,783	524,109	658,521	768,015	878,793	978,214	1,133,289
Local Service Airlines									
Passenger	$2,280	4,667	7,362	10,303	16,259	19,766	23,306	27,673	32,825
Freight	$ 17	76	138	212	309	405	462	503	555
U. S. Mail	$5,920	10,911	13,533	16,400	18,850	21,177	24,356	24,652	21,809
Express	$ 43	72	114	230	357	417	463	497	664
Other	$ 151	195	271	538	966	614	771	1,148	1,288
Total	$8,411	15,921	21,418	27,683	36,741	42,379	49,358	54,473	57,141
Territorial Airlines									
Passenger	$3,102	3,888	3,794	4,105	4,639	4,433	4,771	5,268	5,686
Freight	$ 321	302	333	288	393	562	692	734	753
U. S. Mail	$ 162	189	247	285	643	768	1,128	638	339
Express	$ 108	134	145	125	119	63	....	....	....
Other	$ 208	137	259	410	418	420	135	148	336
Total	$3,901	4,650	4,778	5,213	6,212	6,246	6,726	6,788	7,114
Helicopter Airlines									
Passenger	$....	....	....	....	....	....	10	61	209
Freight	$....	....	....	....	....	....	4	14	23
U. S. Mail	$37	372	522	791	887	1,033	2,547	2,876	2,961
Express	$....	....	....	....	....	....	....	31	99
Other	$....	....	....	7	5	13	44	87	63
Total	$37	372	522	798	892	1,046	2,605	3,069	3,355
International and Overseas Airlines									
Passenger	$140,652	151,338	158,480	160,673	184,592	212,458	232,539	254,234	314,905
Freight	$ 689	1,370	2,105	5,881	25,116	26,730	27,257	29,614	31,889
U. S. Mail	$ 32,300	57,332	75,197	55,689	53,213	51,533	53,746	49,192	27,133
Express	$ 16,837	19,438	20,023	15,783	94	87	74	70	77
Other	$ 18,532	19,756	18,350	22,105	24,784	24,110	23,670	25,746	10,949
Total	$209,010	249,234	274,155	260,131	287,799	314,918	337,286	358,856	384,953

OPERATING REVENUES *(continued)*

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

		1947	1948	1949	1950	1951	1952	1953	1954	1955
Alaskan Airlines										
Passenger	$		2,492	2,188	2,758	4,042	5,857	6,815	6,481	8,160
Freight	$		529	547	639	928	1,474	1,851	1,840	2,464
U. S. Mail	$		1,530	2,122	2,939	3,742	7,524	9,060	9,232	7,975
Other	$		3,798	3,639	3,102	3,430	1,106	1,574	1,653	3,794
Total	$		8,349	8,496	9,438	12,142	15,961	19,300	19,206	22,393
Total Scheduled Airline Industry										
Passenger		$449,228	497,121	549,937	607,937	779,820	913,771	1,043,223	1,166,551	1,383,633
Freight		$ 9,385	16,102	21,446	28,718	47,776	54,700	59,607	65,713	75,258
U. S. Mail		$ 61,745	118,172	136,652	122,415	114,375	117,945	127,920	123,900	90,353
Express		$ 27,518	29,608	29,239	28,707	15,276	16,420	17,366	15,704	20,241
Other		$ 25,973	30,876	31,878	39,595	45,060	45,729	45,952	48,738	38,760
Total		$573,849	691,879	769,152	827,372	1,002,307	1,148,56	1,294,068	1,420,606	1,608,245

DISTRIBUTION OF AIRCRAFT OPERATING EXPENSES

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Domestic Trunk Airlines									
Flying Operations	$ 85,933	104,164	119,961	132,060	160,469	193,384	234,928	260,233	302,526
% of Total Expenses	23.0	25.3	27.6	28.6	29.0	28.7	29.7	29.6	30.0
Direct Maint.—Flight Equip.	$ 41,029	46,093	50,270	53,747	66,571	86,452	94,816	103,104	127,418
% of Total Expenses	11.0	11.2	11.6	11.6	12.0	12.8	12.0	11.7	12.6
Depreciation—Flight Equip.	$ 36,241	39,534	39,448	39,430	41,273	57,735	79,305	94,344	90,226
% of Total Expenses	9.7	9.6	9.1	8.5	7.5	8.6	10.0	10.7	8.9
Total Aircraft Oper. Expenses	$163,203	189,791	209,679	225,237	268,313	337,571	409,049	457,681	520,170
Local Service Airlines									
Flying Operations	$2,190	4,433	6,336	8,330	10,394	13,394	15,748	17,246	18,070
% of Total Expenses	24.3	28.5	29.0	30.8	30.5	30.8	30.9	32.5	31.8
Direct Maint.—Flight Equip.	$1,332	2,289	3,198	3,433	4,284	5,451	6,479	5,950	6,709
% of Total Expenses	14.8	14.7	14.6	12.7	11.9	12.5	12.7	11.2	11.8
Depreciation—Flight Equip.	$ 908	1,375	1,938	1,492	1,613	2,443	1,893	1,818	1,818
% of Total Expenses	10.1	8.8	8.4	5.5	4.5	4.8	4.8	3.6	3.2
Total Aircraft Oper. Expenses	$4,430	8,097	11,472	13,255	16,841	20,943	24,670	25,089	26,597

DISTRIBUTION OF AIRCRAFT OPERATING EXPENSES *(continued)*

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Territorial Airlines									
Flying Operations	$ 704	946	1,091	1,221	1,468	1,623	1,875	1,908	1,942
% of Total Expenses	18.8	21.3	22.6	23.1	24.2	27.2	27.7	27.0	26.5
Direct Maint.—Flight Equip.	$ 537	603	551	543	644	580	625	712	716
% of Total Expenses	14.4	13.6	11.4	10.3	10.6	9.7	9.2	10.1	9.8
Depreciation—Flight Equip.	$ 259	330	331	359	253	143	392	482	488
% of Total Expenses	6.9	7.4	6.9	6.8	4.2	2.4	5.8	6.8	6.7
Total Aircraft Oper. Expenses	$1,500	1,879	1,973	2,123	2,365	2,346	2,892	3,102	3,146
Helicopter Airlines									
Flying Operations	$13	94	151	205	135	264	540	583	611
% of Total Expenses	25.0	27.2	29.6	28.0	18.7	25.1	22.8	22.1	20.7
Direct Maint.—Flight Equip.	$ 5	50	83	117	182	213	481	533	566
% of Total Expenses	9.6	14.5	16.3	16.0	25.2	20.3	20.3	20.2	19.2
Depreciation—Flight Equip.	$14	81	105	123	76	128	456	391	405
% of Total Expenses	26.9	23.4	20.6	16.8	10.5	12.2	19.3	14.8	13.7
Total Aircraft Oper. Expenses	$32	225	339	445	393	605	1,477	1,507	1,582
International and Overseas Airlines									
Flying Operations	$53,189	67,163	72,347	70,980	75,031	87,368	91,489	98,755	108,553
% of Total Expenses	25.4	28.5	28.6	28.6	27.8	28.7	28.8	29.7	29.7
Direct Maint.—Flight Equip.	$21,997	24,241	26,311	26,158	28,856	33,043	32,808	30,813	34,850
% of Total Expenses	10.5	10.3	10.4	10.5	11.1	10.9	10.3	9.3	9.5
Depreciation—Flight Equip.	$18,580	19,589	23,676	25,638	24,263	26,480	26,723	27,799	27,547
% of Total Expenses	8.9	8.3	9.4	10.3	9.0	8.7	8.4	8.4	7.5
Total Aircraft Oper. Expenses	$93,766	110,993	122,334	122,776	129,150	146,891	151,020	157,367	170,950
Alaskan Airlines									
Flying Operations	$	3,138	3,440	3,020	4,160	4,634	5,479	5,224	7,232
% of Total Expenses		38.9	33.8	31.1	31.6	28.4	30.0	28.9	33.0
Direct Maint.—Flight Equip.	$	923	1,342	1,591	2,257	2,744	2,673	2,581	3,288
% of Total Expenses		11.4	13.2	16.4	17.2	16.8	14.7	14.3	15.0
Depreciation—Flight Equip.	$	810	987	880	718	741	863	1,087	899
% of Total Expenses		10.0	9.7	9.1	5.5	4.5	4.7	6.0	4.1
Total Aircraft Oper. Expenses	$	4,871	5,769	5,491	7,135	8,119	9,015	8,892	11,419
Total Scheduled Airline Industry									
Flying Operations	$142,029	179,938	203,326	215,816	252,207	300,667	350,059	383,949	438,934
% of Total Expenses	23.9	26.7	28.0	28.7	28.7	28.8	29.5	29.7	30.0
Direct Maint.—Flight Equip.	$ 64,900	74,199	81,755	85,589	103,794	128,483	137,882	143,693	173,547
% of Total Expenses	10.9	11.0	11.3	11.4	11.8	12.3	11.6	11.1	11.8
Depreciation—Flight Equip.	$ 56,002	61,719	66,485	67,922	68,196	87,325	110,182	125,996	121,383
% of Total Expenses	9.4	9.1	9.2	9.0	7.8	8.4	9.3	9.7	8.3
Total Aircraft Oper. Expenses	$262,931	315,856	351,566	369,327	424,197	516,475	598,123	653,638	733,864

DISTRIBUTION OF GROUND AND INDIRECT EXPENSES

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Domestic Trunk Airlines									
Ground Operations	$ 59,464	64,915	66,623	68,541	79,265	94,606	107,044	119,207	133,231
Ground and Indirect Maintenance	$ 32,812	33,515	33,404	33,653	41,110	50,856	56,940	61,331	68,736
Passenger Service	$ 28,669	29,151	27,778	30,870	42,563	47,045	53,115	58,235	72,978
Traffic and Sales	$ 42,644	42,668	45,661	48,079	58,024	70,253	81,472	89,288	103,882
Advertising and Publicity	$ 9,486	12,343	13,533	14,566	16,211	18,880	22,027	24,861	30,809
General and Administrative	$ 31,052	31,217	30,894	33,651	40,816	46,874	52,259	57,744	68,599
Depreciation—Ground Equipment	$ 6,060	7,678	7,585	6,941	6,279	6,807	8,515	10,411	11,430
Total—Ground and Indirect Expenses	$210,187	221,487	225,478	236,301	284,268	335,321	381,372	421,077	489,665
Local Service Airlines									
Ground Operations	$1,650	2,682	3,743	4,969	6,229	7,254	8,406	8,753	9,511
Ground and Indirect Maintenance	$ 740	1,114	1,339	1,823	2,496	3,150	3,596	3,666	3,756
Passenger Service	$ 261	540	825	1,090	1,671	1,944	2,218	2,389	2,684
Traffic and Sales	$ 660	1,053	1,771	2,434	3,943	4,868	6,099	6,895	7,618
Advertising and Publicity	$ 251	386	634	807	1,072	1,172	1,340	1,449	1,656
General and Administrative	$ 902	1,436	1,792	2,367	3,247	3,682	4,028	4,330	4,476
Depreciation—Ground Equipment	$ 123	270	295	344	440	484	546	535	554
Total—Ground and Indirect Expenses	$4,587	7,481	10,399	13,834	19,098	22,554	26,233	28,017	30,255
Territorial Airlines									
Ground Operations	$ 767	904	922	906	1,040	1,002	1,212	1,268	1,258
Ground and Indirect Maintenance	$ 342	357	349	399	433	384	482	532	562
Passenger Service	$ 97	140	165	190	223	213	210	198	245
Traffic and Sales	$ 385	441	528	681	858	881	768	769	842
Advertising and Publicity	$ 50	42	100	151	172	167	143	140	204
General and Administrative	$ 502	567	682	743	887	899	953	955	963
Depreciation—Ground Equipment	$ 96	103	113	93	89	81	97	114	116
Total—Ground and Indirect Expenses	$2,239	2,554	2,859	3,163	3,702	3,627	3,865	3,976	4,190
Helicopter Airlines									
Ground Operations	$ 3	33	50	98	108	138	283	334	425
Ground and Indirect Maintenance	$ 6	39	50	66	89	124	217	275	305
Passenger Service	$....	....	....	....	....	....	11	15	22
Traffic and Sales	$....	....	....	....	....	....	26	75	141
Advertising and Publicity	$....	2	2	2	1	3	17	32	40
General and Administrative	$ 9	43	63	112	119	164	306	365	392
Depreciation—Ground Equipment	$ 2	4	6	10	11	16	30	35	45
Total—Ground and Indirect Expenses	$20	121	171	288	328	445	890	1,131	1,370
International and Overseas Airlines									
Ground Operations	$ 30,460	31,005	33,168	31,618	34,916	39,726	42,189	43,397	47,050
Ground and Indirect Maintenance	$ 17,805	20,219	20,934	17,282	20,014	21,188	22,219	22,302	24,236
Passenger Service	$ 13,084	14,034	14,617	14,589	17,511	19,554	20,027	22,372	26,716
Traffic and Sales	$ 21,996	25,350	25,560	25,886	29,821	34,945	37,727	40,573	45,872
Advertising and Publicity	$ 6,745	7,861	10,171	10,628	11,374	12,541	13,692	14,273	16,095
General and Administrative	$ 22,722	22,887	22,600	22,170	23,903	26,754	27,931	28,970	31,377
Depreciation—Ground Equipment	$ 2,716	2,938	3,479	3,374	3,041	2,668	3,102	3,434	3,526
Total—Ground and Indirect Expenses	$115,528	124,294	130,529	125,547	140,580	157,376	166,887	175,321	194,872

DISTRIBUTION OF GROUND AND INDIRECT EXPENSES *(continued)*

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Alaskan Airlines									
Ground Operations	.....	$ 845	988	966	1,411	2,182	2,449	2,612	4,224
Ground and Indirect Maintenance	.....	$ 525	1,001	774	1,429	1,923	1,919	1,997	2,010
Passenger Service	.....	$ 268	370	358	501	694	797	696	771
Traffic and Sales	.....	$ 435	598	499	699	1,170	1,364	1,384	1,321
Advertising and Publicity	.....	$ 102	116	135	175	209	297	265	275
General and Administrative	.....	$ 903	1,180	1,332	1,591	1,767	2,100	1,952	1,582
Depreciation—Ground Equipment	.....	$ 121	156	148	204	264	302	308	310
Total—Ground and Indirect Expenses	.....	$3,199	4,409	4,212	6,010	8,209	9,228	9,214	10,493
Total Scheduled Airline Industry									
Ground Operations	$ 92,344	100,384	105,494	107,098	122,969	144,908	161,583	175,571	195,699
Ground and Indirect Maintenance	$ 51,705	55,769	57,077	53,997	65,571	77,625	85,373	90,103	99,605
Passenger Service	$ 42,111	44,133	43,755	47,097	62,469	69,450	76,378	83,905	103,416
Traffic and Sales	$ 65,685	69,947	74,118	77,579	93,345	112,117	127,456	138,984	159,676
Advertising and Publicity	$ 16,532	20,736	24,556	26,289	29,005	32,972	37,516	41,020	49,079
General and Administrative	$ 55,187	57,053	57,211	60,375	70,563	80,140	87,577	94,316	107,389
Depreciation—Ground Equipment	$ 8,997	11,114	11,634	10,910	10,064	10,320	12,592	14,837	15,981
Total—Ground and Indirect Expenses	$332,561	359,136	373,845	383,345	453,986	527,532	588,475	638,736	730,845

SUMMARY OF PROFIT OR LOSS

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Domestic Trunk Airlines									
Total Operating Revenues	$352,490	413,353	459,783	524,109	658,521	768,015	878,793	978,214	1,133,289
Total Operating Expenses	$373,390	411,278	435,157	461,538	552,581	672,892	790,421	878,758	1,009,835
Net Operating Income	$(20,900)	2,075	24,626	62,571	105,940	95,123	88,372	99,456	123,454
Net Income Before Income Taxes[1]	$(26,258)	(1,413)	20,663	59,305	103,355	102,814	96,008	102,161	133,330
Income Taxes	$ (6,016)	3,583	7,285	28,426	59,858	49,280	47,624	50,671	70,229
Net Profit or Loss	$(20,242)	(4,996)	13,378	30,879	43,497	53,534	48,384	51,490	63,101
Local Service Airlines									
Total Operating Revenues	$ 8,411	15,921	21,418	27,683	36,741	42,379	49,358	54,473	57,141
Total Operating Expenses	$ 9,017	15,578	21,871	27,089	35,939	43,497	50,903	53,106	56,852
Net Operating Income	$ (606)	343	(453)	594	802	(1,118)	(1,545)	1,367	289
Net Income Before Income Taxes[1]	$(1,182)	(486)	(1,283)	(176)	601	(345)	(2,080)	1,212	65
Income Taxes	$ (77)	94	168	399	399	141	(47)	254	205
Net Profit or Loss	$(1,105)	(580)	(1,451)	(575)	202	(486)	(2,033)	958	(140)

[1] Net income before income taxes is adjusted for nonoperating items.

( ) Denotes red figure.

SUMMARY OF PROFIT OR LOSS *(continued)*

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Territorial Airlines									
Total Operating Revenues	$3,901	4,650	4,778	5,213	6,212	6,246	6,726	6,788	7,114
Total Operating Expenses	$3,739	4,433	4,832	5,286	6,067	5,973	6,757	7,078	7,336
Net Operating Income	$ 162	217	(54)	(73)	145	273	(31)	(290)	(222)
Net Income Before Income Taxes[1]	$ 124	167	(132)	(135)	125	254	(10)	(454)	(118)
Income Taxes	$ 35	65	57	3	77	88	(51)	(27)	8
Net Profit or Loss	$ 89	102	(189)	(138)	48	166	41	(427)	(126)
Helicopter Airlines									
Total Operating Revenues	$ 37	372	522	798	892	1,046	2,605	3,069	3,355
Total Operating Expenses	$ 52	346	510	733	721	1,050	2,367	2,638	2,952
Net Operating Income	$(15)	26	12	65	171	(4)	238	431	403
Net Income Before Income Taxes[1]	$(22)	(4)	(16)	36	138	(50)	168	353	547
Income Taxes	$	....	....	8	42	30	68	163	203
Net Profit or Loss	$(22)	(4)	(16)	28	96	(80)	100	190	344
International and Overseas Airlines									
Total Operating Revenues	$209,010	249,234	274,155	260,131	287,799	314,918	337,286	358,856	384,953
Total Operating Expenses	$209,294	235,287	252,863	248,323	269,730	304,267	317,907	332,688	365,822
Net Operating Income	$ (284)	13,947	21,292	11,808	18,069	10,651	19,379	26,168	19,130
Net Income Before Income Taxes[1]	$ (4,473)	8,780	8,816	13,631	18,801	14,380	23,393	29,723	23,481
Income Taxes	$ 651	2,415	1,362	3,623	7,063	6,651	10,865	13,047	10,314
Net Profit or Loss	$ (5,124)	6,365	7,454	10,008	11,738	7,729	12,528	16,676	13,167
Alaskan Airlines									
Total Operating Revenues	.....	$8,349	8,496	9,438	12,142	15,961	19,300	19,206	22,393
Total Operating Expenses	.....	$8,070	10,178	9,703	13,145	16,328	18,243	18,106	21,912
Net Operating Income	.....	$ 279	(1,682)	(265)	(1,003)	(367)	1,057	1,100	481
Net Income Before Income Taxes[1]	.....	$ 171	(1,817)	(396)	(1,196)	(78)	873	1,126	651
Income Taxes	.....	$ 26	15	37	24	373	113	232	367
Net Profit or Loss	.....	$ 145	(1,832)	(433)	(1,220)	(451)	760	894	284
Total Scheduled Airline Industry									
Total Operating Revenues	$573,849	691,879	769,152	827,372	1,002,307	1,148,565	1,294,068	1,420,606	1,608,245
Total Operating Expenses	$595,492	674,992	725,411	752,672	878,183	1,044,007	1,186,598	1,292,374	1,464,709
Net Operating Income	$(21,643)	16,887	43,741	74,700	124,124	104,558	107,490	128,232	143,535
Net Income Before Income Taxes[1]	$(31,811)	7,215	26,231	72,265	121,824	116,975	118,352	134,121	157,956
Income Taxes	$ (5,407)	6,183	8,887	32,496	67,463	56,563	58,572	64,340	81,326
Net Profit or Loss	$(26,404)	1,032	17,344	39,769	54,361	60,412	59,780	69,781	76,630

[1] Net income before taxes is adjusted for nonoperating items.

() Denotes red figures.

ASSETS, LIABILITIES AND CAPITAL

U. S. Scheduled Airlines, for selected years (In Thousands of Dollars)

	1948	1950	1952	1954	1955[1]
Domestic Trunk Airlines					
Assets					
Current Assets	$171,860	203,952	344,115	358,375	418,408
Flight Equipment	$299,261	274,803	576,787	782,816	868,270
— Depreciation	$110,910	173,183	258,431	394,292	458,317
Flight Equipment—Net	$188,351	201,620	309,356	388,524	409,953
Ground Property and Equipment—Net	$ 73,722	59,265	76,506	90,371	96,563
Property and Equipment—Net	$262,073	260,885	385,862	478,895	506,516
Deferred Charges	$ 16,497	16,361	8,194	9,211	10,274
Other Assets	$ 33,811	61,341	37,593	38,035	35,281
Total Assets	$484,241	542,539	775,764	884,516	970,479
Liabilities and Capital					
Current Liabilities	$ 99,837	130,107	231,760	241,942	270,746
Long Term Debt	$167,404	135,842	168,247	185,093	169,097
Operating Reserves	$ 2,387	3,971	4,169	5,796	8,531
Capital Stock	$121,313	123,469	145,135	139,360	110,017
Capital Surplus	$ 60,573	64,644	89,028	91,845	128,509
Earned Surplus	$ 13,943	67,179	133,532	207,947	246,621
Other Liabilities and Capital	$ 18,784	17,327	3,893	12,533	36,958
Total Liabilities and Capital	$484,241	542,539	775,764	884,516	970,479
Local Service Airlines					
Assets					
Current Assets	$ 5,279	7,577	10,359	11,927	11,732
Flight Equipment	$ 5,671	10,056	16,404	17,693	21,063
— Depreciation	$ 2,396	5,020	6,788	9,873	10,950
Flight Equipment—Net	$ 3,275	5,036	9,616	7,280	10,113
Ground Property and Equipment—Net	$ 2,016	1,882	3,722	2,735	3,282
Property and Equipment—Net	$ 5,291	6,918	13,338	10,555	13,395
Deferred Charges	$ 1,349	1,743	1,209	1,018	886
Other Assets	$ 819	521	917	573	848
Total Assets	$12,738	16,759	25,823	24,073	26,861
Liabilities and Capital					
Current Liabilities	$ 3,333	6,542	10,346	10,666	11,116
Long Term Debt	$ 1,590	1,485	3,575	1,931	3,650
Operating Reserves	$ 105	287	357	616	728
Capital Stock	$ 4,832	6,938	7,218	6,720	6,717
Capital Surplus	$ 4,454	4,193	5,633	4,654	4,319
Earned Surplus	$(1,665)	(2,815)	(1,821)	(556)	(91)
Other Liabilities and Capital	$ 89	129	515	42	422
Total Liabilities and Capital	$12,738	16,759	25,823	24,073	26,861
Territorial Airlines					
Assets					
Current Assets	$1,333	1,649	1,900	1,577	968
Flight Equipment	$2,411	2,300	4,338	6,354	5,824
— Depreciation	$1,261	1,653	2,277	2,899	2,908
Flight Equipment—Net	$1,150	647	2,061	3,455	2,916
Ground Property and Equipment—Net	$ 530	487	887	630	467
Property and Equipment—Net	$1,680	1,134	2,948	4,085	3,383
Deferred Charges	$ 85	72	268	161	188
Other Assets	$ 65	227	526	9	15
Total Assets	$3,163	3,082	5,642	5,832	4,554
Liabilities and Capital					
Current Liabilities	$ 486	466	1,601	1,751	1,717
Long Term Debt	$ 4	-----	1,222	1,725	1,379
Operating Reserves	$ 62	47	79	84	20
Capital Stock	$1,845	1,845	2,775	2,776	1,981
Capital Surplus	$ 372	372	372	386	832
Earned Surplus	$ 305	278	(419)	(895)	(1,378)
Other Liabilities and Capital	$ 89	74	12	5	3
Total Liabilities and Capital	$3,163	3,082	5,642	5,832	4,554

[1] Data for 1955 are as at Sept. 30th.

ASSETS, LIABILITIES AND CAPITAL *(continued)*

U. S. Scheduled Airlines, for selected years (In Thousands of Dollars)

	1948	1950	1952	1954	1955[1]
Helicopter Airlines					
Assets					
Current Assets	$ 63	302	900	2,659	2,519
Flight Equipment	$297	528	1,371	2,285	2,463
— Depreciation	$ 94	285	385	1,176	1,270
Flight Equipment—Net	$203	243	986	1,109	1,193
Ground Property and Equipment—Net	$ 10	32	105	158	223
Property and Equipment—Net	$213	275	1,091	1,267	1,416
Deferred Charges	$ 89	71	263	145	165
Other Assets	$ 1	84	113	42	23
Total Assets	$366	732	2,367	4,113	4,123
Liabilities and Capital					
Current Liabilities	$ 97	69	430	656	502
Long Term Debt	.....	.....	138	204	116
Operating Reserves	.....	.....	4	33	43
Capital Stock	$294	695	816	899	892
Capital Surplus	.....	.....	974	1,998	1,998
Earned Surplus	$(25)	(32)	5	309	551
Other Liabilities and Capital	.....	.....	.....	14	21
Total Liabilities and Capital	$366	732	2,367	4,113	4,123
International and Overseas Airlines					
Assets					
Current Assets	$ 71,748	93,957	79,437	99,695	119,706
Flight Equipment	$ 94,782	133,489	164,524	193,798	212,540
— Depreciation	$ 32,398	55,495	76,243	91,061	98,779
Flight Equipment—Net	$ 62,384	77,994	88,281	102,737	113,761
Ground Property and Equipment—Net	$ 15,030	12,231	12,775	13,380	13,659
Property and Equipment—Net	$ 77,414	90,225	101,056	116,177	127,420
Deferred Charges	$ 24,909	25,688	20,706	4,685	5,167
Other Assets	$ 30,403	9,190	16,554	21,273	27,925
Total Assets	$204,474	219,070	217,753	241,770	280,218
Liabilities and Capital					
Current Liabilities	$ 31,477	52,623	66,986	81,341	91,108
Long Term Debt	$ 5,800	41,250	27,955	29,575	45,266
Operating Reserves	$ 5,438	5,776	6,314	3,637	4,022
Capital Stock	$ 7,665	10,766	10,895	13,068	13,912
Capital Surplus	$ 30,518	62,828	62,828	62,880	63,120
Earned Surplus	$ 18,691	26,024	33,584	47,184	56,553
Other Liabilities and Capital	$104,885	19,803	9,191	4,085	6,237
Total Liabilities and Capital	$204,474	219,070	217,753	241,770	280,218
Alaskan Airlines					
Assets					
Current Assets	$3,203	2,800	4,141	4,591	6,219
Flight Equipment	$4,146	4,629	5,856	8,251	6,957
— Depreciation	$1,743	3,125	4,026	5,307	5,076
Flight Equipment—Net	$2,403	1,504	1,830	2,944	1,881
Ground Property and Equipment—Net	$1,197	1,125	2,212	2,225	2,307
Property and Equipment—Net	$3,600	2,629	4,042	5,169	4,188
Deferred Charges	$ 177	130	230	172	342
Other Assets	$ 262	281	255	347	372
Total Assets	$7,242	5,840	8,668	10,279	11,121
Liabilities and Capital					
Current Liabilities	$ 2,685	2,571	4,878	3,449	3,808
Long Term Debt	$ 408	475	1,634	1,419	1,001
Operating Reserves	$ 175	313	388	342	447
Capital Stock	$ 1,746	1,833	2,258	2,680	2,944
Capital Surplus	$ 3,256	3,248	3,121	3,800	3,578
Earned Surplus	$(1,073)	(2,626)	(3,648)	(1,593)	(832)
Other Liabilities and Capital	$ 45	26	37	182	175
Total Liabilities and Capital	$ 7,242	5,840	8,668	10,279	11,121

[1] Data for 1955 are as at Sept. 30th.

ASSETS, LIABILITIES AND CAPITAL *(continued)*

U. S. Scheduled Airlines, 1947-1955 (In Thousands of Dollars)

	1948	1950	1952	1954	1955[1]
Consolidated Industry					
Assets					
Current Assets	$253,486	310,247	440,852	478,824	559,552
Flight Equipment	$406,568	525,805	760,280	1,011,197	1,117,117
— Depreciation	$148,802	238,761	348,150	504,608	577,300
Flight Equipment—Net	$257,766	287,044	412,130	506,589	539,817
Ground Property and Equipment—Net	$ 92,505	75,022	96,207	109,499	116,501
Property and Equipment—Net	$350,271	362,066	508,337	616,088	656,318
Deferred Charges	$ 43,106	44,065	30,870	15,392	17,022
Other Assets	$ 65,361	71,644	55,958	60,279	64,464
Total Assets	$712,224	788,022	1,036,017	1,170,583	1,297,356
Liabilities and Capital					
Current Liabilities	$137,915	192,378	316,001	339,805	378,997
Long Term Debt	$175,206	179,052	202,771	219,947	220,509
Operating Reserves	$ 8,167	10,394	11,311	10,508	13,791
Capital Stock	$137,695	145,546	169,097	165,503	136,463
Capital Surplus	$ 99,173	135,285	161,956	165,563	202,356
Earned Surplus	$ 30,176	88,008	161,233	252,396	301,424
Other Liabilities and Capital	$123,892	37,359	13,648	16,867	43,816
Total Liabilities and Capital	$712,224	788,022	1,036,017	1,170,583	1,297,356

[1] Data for 1955 are as at Sept. 30th.

INTERCITY PASSENGER MILE MARKET

Common Carriers and Private Automobile, 1947-1955

(Millions of Passenger Miles)

	1947	1948	1949	1950	1951	1952	1953	1954	1955[1]
Pullman & Air Travel									
Rail Pullman	12,261	11,015	9,349	9,340	10,226	9,504	7,950	6,850	6,430
Domestic Trunk Lines	6,016	5,840	6,563	7,766	10,211	12,121	14,298	16,288	19,341
Local Service Airlines	46	88	135	189	290	340	391	407	523
Pullman and Air Combined	18,323	16,943	16,047	17,295	20,727	21,965	22,639	23,545	26,294
Airline % of Combined Total	33.08	34.99	41.74	46.00	50.66	56.73	64.88	70.91	75.55
Other Common Carriers									
Rail Coach	27,665	24,315	20,273	17,441	19,524	19,758	18,955	17,689	17,315
Intercity Motor Bus Lines	23,948	23,529	22,411	21,254	21,499	20,732	19,700	16,934	16,850
Total	51,613	47,844	42,684	38,695	41,023	40,490	38,655	34,623	34,165
Total Common Carrier	69,936	64,787	58,731	55,990	61,750	62,455	61,294	58,168	60,459
% Airline of Common Carrier	8.67	9.15	11.40	14.21	17.01	19.95	23.96	28.70	32.86
Private Intercity Automobile	272,958	287,423	316,774	337,339	379,324	410,300	432,100	549,000	575,000
Total Common and Private Carrier	342,894	352,210	375,505	393,329	441,074	472,755	493,394	607,168	635,459
Passenger Mile per Capita[2]	2,392	2,412	2,528	2,619	2,919	2,988	3,068	3,742	3,812

[1] Estimated
[2] Not in millions

REVENUE PASSENGERS CARRIED

U. S. Scheduled Airline Industry, 1947-1955 (In Thousands of Passengers)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Domestic Trunk Airlines	12,279	12,324	14,021	15,978	20,621	22,759	26,137	29,526	34,466
Local Service Airlines	236	426	678	969	1,481	1,736	2,032	2,423	2,897
Territorial Airlines	376	418	382	477	550	515	553	561	591
Helicopter Airlines							1	9	29
International and Overseas Airlines	1,360	1,373	1,520	1,675	2,033	2,362	2,682	2,888	3,376
Alaskan Airlines[1]		111	122	144	157	194	220	225	264
Total Scheduled Airline Industry	14,251	14,652	16,723	19,243	24,842	27,566	31,625	35,632	41,623

[1] Alaskan data for 1948 thru 1950 includes charter flights.

AVERAGE PASSENGER FARE

Intercity Common Carriers, 1947-1955 (In Cents Per Mile)

	1947	1948	1949	1950	1951	1952	1953	1954[1]	1955[2]
Domestic Scheduled Airlines[1]									
Coach or Tourist	.....	.....	3.96	4.10	4.45	4.18	4.13	4.34	4.36
All Services	5.06	5.76	5.76	5.55	5.60	5.55	5.43	5.37	5.34
Int'l Scheduled Airlines									
Coach or Tourist	.....	.....	.....	.....	.....	.....	5.77	5.83	n.a.
All Services	7.77	8.01	7.72	7.28	7.13	7.05	6.87	6.79	6.69
Intercity Railroads									
First Class	2.74	3.01	3.14	3.25	3.27	3.35	3.38	3.35	3.31
Coach	2.02	2.29	2.41	2.47	2.47	2.53	2.53	2.50	2.47
Intercity Motor Busses	1.70	1.74	1.84	1.88	1.94	2.02	2.05	2.07	2.06

[1] Includes trunk, local service and territorial airlines.
[2] Estimated.
n.a.—Not Available.

NEW TYPE AIRCRAFT IN SCHEDULED SERVICE

Operated as of December 31, 1955 and Cumulated Inventory, Actual and on Order through 1960 . . . U. S. Domestic and International Airlines

Aircraft Type	Number of Aircraft In Scheduled Service as of 12/31/55	Cumulative Aircraft To Be Operated 1956	1957	1960
B-707	0	0	0	70
CV-340	123	123	123	123
CV-440	0	18	19	19
DC-6	245	272	315	321
DC-7	92	136	207	221
DC-8	0	0	0	84
Electra	0	0	0	107
L-1049	63	81	81	81
L-1649	0	0	25	25
M-404	99	99	99	99
Viscount	6	58	60	75
Total	628	787	929	1,225

AIRCRAFT OPERATED

by U. S. Scheduled Airline Industry, as of December 31, for selected years

Aircraft Type	Number of Engines	1946 Domestic[3]	1946 Int'l[2]	1952 Domestic[3]	1952 Int'l[2]	1954 Domestic[3]	1954 Int'l[2]	1955 Domestic[3]	1955 Int'l[2]
Boeing									
247-D	2	4	3	.....	.....	.....	.....	.....	.....
307-B	4	5	.....	.....	.....	.....	.....	.....	.....
377	4	.....	.....	16	44	11	37	10	36
Convair									
240	2	.....	.....	99	91	92	86	93	79
340	2	.....	.....	25	.....	121	32	122	32
Douglas									
DC-3	2	470	63	381	41	299	41	302	10
DC-4	4	158	50	124	101	109	76	89	78
DC-6/6A/6B	4	.....	.....	161	124	185	179	173	226
DC-7	4	.....	.....	.....	.....	61	41	63	53
Lockheed									
Electra	2	3	.....	.....	.....	.....	.....	.....	.....
Lodestar	2	11	.....	11	.....	11	11	10	.....
Constellation	4	12	31	101	64	102	58	80	76
Super Const.	4	.....	.....	24	14	39	29	53	65
Martin									
202/202A	2	.....	.....	21	.....	25	.....	18	.....
404	2	.....	.....	96	.....	100	.....	100	.....
Vickers									
Viscount	4	.....	.....	.....	.....	.....	.....	5	.....
Total		673[3]	147	1,058	479	1,155	590	1,118	655

[1] Includes Domestic Trunk, Local Service and Territorial Airlines.

[2] Trunk Airlines who operate Domestic and International Routes usually have their aircraft certificated for both operations in order to use these aircraft interchangeably. The number of aircraft certificated for both operations and therefore, duplicated in the international figures given above are as follows: 1946—16; 1952—253; 1954—434; 1955—443.

[3] Total Domestic for 1946 includes 10 Stinson.

AIRCRAFT OPERATIONS AT CAA AIRPORT TOWERS

1947-1955 (In Thousands)

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Type of Flight Operation									
Military	1,595	2,259	2,780	2,384	2,852	2,983	3,712	4,409	4,975
Civil	13,221	12,877	10,446	9,585	9,618	7,965	7,719	8,015	8,540
Air Carrier	2,854	3,242	3,713	4,002	4,556	4,866	5,384	5,521	5,983
Total	17,670	18,378	16,939	15,971	17,026	15,814	16,815	17,945	19,480
% Air Carrier of Total	16.2	17.6	21.9	25.1	26.8	30.8	32.0	30.8	30.7

NOTES: Air Carriers include scheduled and non scheduled operations.
Each landing is counted as an operation as is also each take off.

COMPARATIVE TRANSPORTATION SAFETY RECORD

Passenger Fatality Rate Per 100,000,000 Passenger Miles, 1947-1955

	1947	1948	1949	1950	1951	1952	1953	1954	1955
Domestic Scheduled Airlines[1]									
Fatalities	199	83	93	96	142	46	86	16	156
Rate	3.2	1.3	1.3	1.1	1.3	0.4	0.6	0.09	0.78
International Scheduled Airlines									
Fatalities	20	20	0	48	31	94	2	0	2
Rate	1.1	1.0	....	2.1	1.1	3.0	0.1	....	0.04
Motor Buses									
Fatalities	140	120	120	100	130	100	70	60	n.a.
Rate	.21	.18	.20	.17	.22	.16	.13	.11	n.a.
Railroad Passenger Trains									
Fatalities	75	52	29	184	150	14	50	23	16 p
Rate	.16	.13	.08	.58	.43	.04	.16	.08	.06 p
Passenger Autos and Taxis									
Fatalities	15,300	15,200	15,300	17,600	21,000	22,600	23,500	22,500	n.a.
Rate	2.3	2.1	2.0	2.2	2.4	2.8	2.9	2.6	n.a.

[1] Includes domestic trunk, local service and territorial airlines.
n.a.—Not Available.
p. —Preliminary

CLASSES OF UNITED STATES COMMERCIAL AIR CARRIERS

At the present time there are seven recognized classes of air carriers in the air transport industry of the United States. This classification is used by the Civil Aeronautics Board in connection with the economic regulation of the industry under the Civil Aeronautics Act is based largely on the scope of operations authorized or allowed by that Act. Classes One to Six have certificates of convenience and necessity and conduct regularly scheduled services.

1. **The Domestic Trunk Lines** include those air carriers which presently have permanent operating rights within the continental United States. These rights derive largely from operations by present or predecessor companies antedating the Civil Aeronautics Act of 1938 which granted them "grandfather rights." There are currently twelve trunk lines, most of which operate high-density traffic routes between the principal traffic centers of the United States.

American	Continental	National	Trans World
Braniff	Delta-C&S	Northeast	United
Capital	Eastern	Northwest	Western
Colonial			

2. **The Domestic Local Service Lines** have, with one exception, been certificated since 1945. These carriers operate routes of lesser traffic density between the smaller traffic centers and between these centers and principal centers. The fourteen local service lines in 1955 were:

Allegheny	Frontier	Ozark	Southwest
Bonanza	Lake Central	Piedmont	Trans Texas
Braniff	Mohawk	Southern	West Coast
Central	North Central		

3. **The International and Overseas Lines** include all U. S. flag air carriers operating between the United States and foreign countries other than Canada. Some of these carriers conduct operations between foreign countries and some are extensions of domestic trunk lines into Mexico and the Caribbean.

American	Eastern	Pacific Northern	South Pacific[2]
Braniff	Mackey[2]	Pan American	Trans World
Caribbean Atlantic	Midet[2]	Pan American-Grace	U. M. C. A.[2]
Colonial	National	Resort[1]	United
Delta-C&S	Northwest	Samoan[2]	

4. **The Territorial Lines** include two groups of carriers. The Insular Lines operate in the U. S. Island possessions in the Pacific and the Caribbean and the Alaskan Lines operate between the U. S. and Alaska and within Alaska.

Insular Lines	*Alaskan Lines*			
	Operating between the U. S. and Alaska		Operators within Alaska	
Hawaiian	Alaska	Pacific Northern	Alaska	Howard J. Mays
Trans-Pacific	Northwest	Pan American	Alaska Coastal	Northern Consolidated
			Bristol Bay	Pacific Northern
			Byers	Pan American
			Cordova	Reeve Aleutian
			Ellis	Wien

5. **The Helicopter Airmail Lines** presently operate between airports, central post offices, and suburbs in New York, Chicago and Los Angeles. Originally certificated as exclusive mail carriers, some of them now fly passengers, air freight and air express. These carriers hold temporary certificates and are considered to be experimental in nature.

Helicopter Air Service	Los Angeles Airways	New York Airways

6. **The All Cargo Lines** operate under special temporary certificates authorizing scheduled cargo flights between designated areas in the U. S., and in one case to the Caribbean and in another to Europe. These carriers cannot carry either air mail or passengers.

Aerovias Sud Americana	Riddle	Slick
Flying Tigers	Seaboard & Western	

7. **Non-certificated Air Carriers** include a diversified group of operators who, with the exception of the air taxi operators and air freight forwarders, are not authorized to engage in regularly scheduled service. They are described in the CAB 1954 Annual Report as follows:

Operators of various types of air services have been authorized by the Board through the exemption process, rather than through the requirement that a certificate of convenience and necessity be obtained. At present this group includes:

Large irregulars and irregular transport carriers	53
Air Taxi operators (includes 50 Alaskan)	1,589
Alaska pilot-owners	153
Air freight forwarders	62

[1] Certificated cruise carrier.

[2] Certificated non-mail carriers. Statistical data of these carriers are not included in the following statistical tables.

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17TH EDITION

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AIR TRANSPORT ASSOCIATION OF AMERICA
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More Foreign Airlines Moving Into Black

Use of modern transports, such as Viscount, Britannia, Convair 440, DC-7C and Super Connie, increases traffic and cuts costs.

By ANTHONY VANDYK

With demand continuing to rise apace with capacity, the airlines of the world are enjoying their greatest prosperity ever. Every five seconds of the day and night an aircraft takes off on a scheduled flight somewhere in the world. The planes are well filled, with load factors on international flights averaging over 60%. Most airlines are making money.

Despite the prosperous appearance of international airline operations today, a closer examination of the scene shows that the facade is somewhat deceptive. While the rate of increase in traffic is definitely healthy, profit margins remain very low. Outside the United States airline profits average well under 1% of total revenues. Nonetheless, even though their profits are small, more and more foreign airlines are moving into the black.

• **An encouraging sign** is that short-haul routes are beginning to become profitable. British European Airways, the world's largest all-short-haul operator, reported a profit ($176,550) for its 1954-55 fiscal year after having been heavily in the red since its establishment in 1946.

The main factor in the achievement of the profit was that total expenditure was held down to only 3.2% more than in the previous year, while output was expanded by 17.6% and revenue by 16%. This was chiefly made possible by the increased number of larger and more economic aircraft.

Modern Transports Lower Costs

BEA has shown that the use of a modern transport like the Viscount lowers operating costs as well as attracting additional traffic. In all parts of the world the swing to new aircraft has been accompanied by a rise in profits. The five transport types currently being delivered are the Bristol Britannia, Convair 440 Metropolitan, Douglas DC-7C, Lockheed Super Constellation (L-1049G and L-1049H) and Vickers Viscount.

• **Despite the deliveries** of new types, most of the world's airlines still have large fleets of aircraft of pre-World War II design. Even BEA, which many believe to be an all-Viscount operator, has over forty DC-3s. Air France has 17 DC-4s and 38 DC-3s. Trans-Canada Air Lines still has 26 DC-3s. In Brazil alone there are some 150 DC-3s in airline service.

The DC-3 continues to be the airlines' workhorse in all of the less developed areas of the world and there seems no likelihood of it being supplanted for many years.

While at one extreme the DC-3 dominates, at the other the Douglas DC-6/7 and the Lockheed Constellation/Super Constellation rule the roost and are likely to continue to do so for several years to come. On the main trunk routes of the world the Wright Turbo Compound-powered DC-7s and Super Constellations set the pace, backed by the older DC-6s, DC-6Bs and Constellations.

• **In the summer of 1955** PAA and Panagra introduced the DC-7B on international route, immediately clipping hours off previous schedules. This model is not going into large-scale use. The only other international operator using it is South African Airways.

Most of the DC-7 series ordered for international use are of the DC-7C type with the new wing. PAA will start DC-7C service on the Atlantic this summer and within the next twelve months the new Douglas model will be in transatlantic service with BOAC, KLM, SABENA, SAS and Swissair.

At present there are considerably more Super Constellations in international operation than there are DC-7 series aircraft. The latest passenger version of the Lockheed transport, the Super G, has been particularly successful while the 1649 version with a new wing looks as though it may represent the ultimate in piston-engine aircraft. It has been ordered by TWA, Air France, LAI and Lufthansa for delivery starting next year.

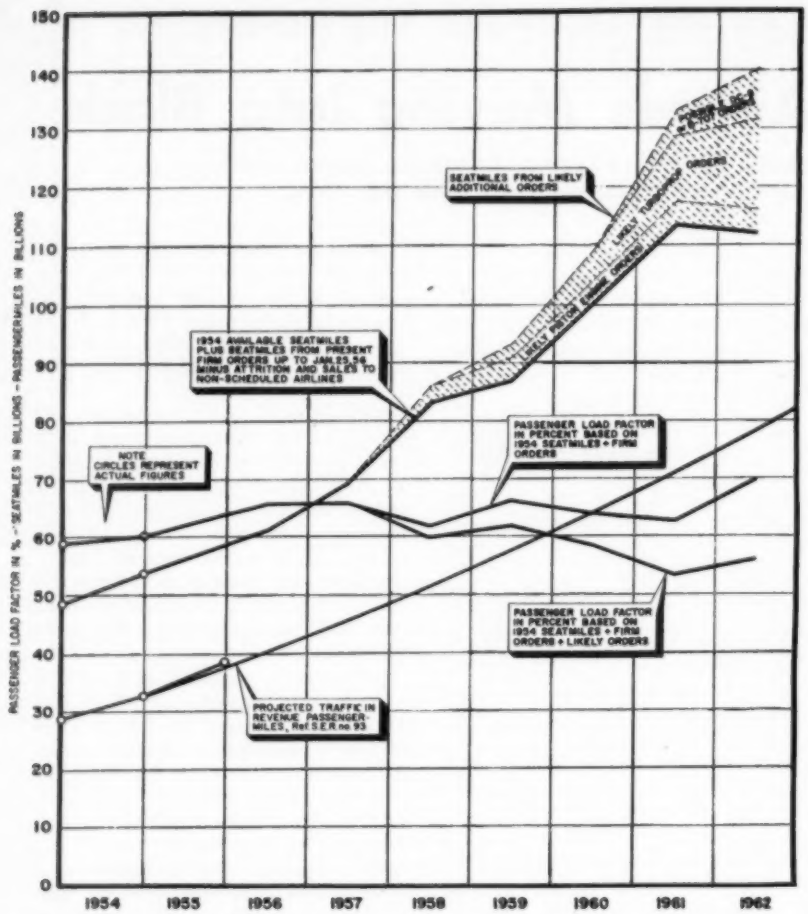
The DC-7C and the L-1649 will make possible non-stop transatlantic flights in both directions throughout the year. On other routes they will cut travel time by reducing the number of intermediate stops. Their range will pay off particularly on the so-called "polar" routes between the U.S. west coast and Europe and between Europe and Japan. SAS will soon inaugurate the latter route with DC-7Cs.

Another aircraft with an impressive range is the Britannia, which is now being delivered to BOAC for operation starting in the summer. By the end of the year the big turboprop transports should be in full service on routes linking London with South Africa and Australia. BOAC also hopes to be able to take advantage of the Britannia's range to start a new "short-cut" route from Europe to the Orient via the Soviet Union. To date, however, the Russians have shown no desire to approve such an operation.

East-West Communications Better

• **Nonetheless,** there is improvement to be reported in air communications between East and West. In February Finland's Aero O/Y became the first airline outside the Communist bloc to

BY MID-SUMMER Viscounts will be in service in many widely-separated parts of the world. Map illustrates the areas in which turboprop transports will be flying in July. By then over 130 will have been delivered. Capital Airlines will have 30 Viscounts, half of the 60 it has ordered.



Seat-miles capacity available to the world's scheduled airlines for the period through mid-1962, according to the estimates of a leading airframe manufacturer.

start service to Russia since the war. The company's Convairs fly into Moscow on a regular schedule. Scandinavian Airlines System has received authorization to link Copenhagen, Oslo and Stockholm with Moscow and plans to start service to the Russian capital next month.

Aeroflot, the Soviet Union's flag carrier, has concluded interline agreements with several European airlines and has coordinated its schedules to enable travelers to make the trip from most Western European countries to Moscow in a day.

The airlines in the Communist countries of Europe have, at least on paper, been allowed to divest themselves of much of the Russian control of their operation. A new—or rather, revived—airline has been created in Eastern Europe, Deutsche Lufthansa. This has proved to be a very minor operation compared with its namesake in Western Germany.

Lufthansa's reappearance and development in the last twelve months has been one of the most discussed features of the international aviation scene. After years of enforced inactivity in the airline field, the Germans have proved in a very short time that they have lost none of their skill at running an efficient air transport system. With an initial fleet of four Convair 340s and four Super Constellations, Lufthansa has carried the German flag to key cities in Western Europe and to the United States.

This spring the West German airline's North American operations have been stepped up with the inauguration of service to Montreal and Chicago. In a few months time a route to South America will be opened and about the same time the Lufthansa system will also be extended to take in Eastern Europe and the Near East.

• **The reappearance of Lufthansa** has put the spotlight on the German cabotage routes currently operated by various foreign airlines including PAA. To several of these companies the loss of traffic rights between the various West German cities would represent a substantial cut in revenue. Nevertheless, all concerned seem agreed that sooner or later the West German government will lower the boom.

Several of the European airlines which would be most affected by the loss of cabotage rights in Germany are among those that have pressed hard for Europe to be regarded as one large nation—"the United States of Europe"—as a means of preventing carriers from other continents, notably America, from carrying fifth freedom traffic between European cities.

(Editor's Note: The "fifth freedom" in air transport was defined by the International Civil Aviation Conference in Chicago in 1944 as the freedom "to carry traffic from a point of origin in one foreign country to a point of destination in another foreign country.")

Last year's Strasbourg conference showed that coordination of transport within Europe to form a "United States" is unlikely to be realized because of the intense nationalism prevalent in Europe. The Strasbourg conference, however, served a useful purpose in providing a forum for the discussion of methods to bring the efficiency of air transport in Europe nearer to North American standards.

Traffic rights and capacity continue to be problems in most parts of the world. The United States last January signed an air agreement with India which in effect permits India to predetermine the frequency and capacity offered by U.S. airlines. Last month the U.S. and Britain had talks in which the latter clearly indicated that it had nothing much to ask of the U.S. so it was therefore prepared to give very little.

This eye for an eye, tooth for a tooth atmosphere pervades most international air negotiations these days. It makes life particularly difficult for "have not" nations like the Netherlands that have little to offer in comparison with what they want from other nations.

Under this handicap it is perhaps surprising that KLM is such a successful operation. The Dutch airline continues to carry large quantities of fifth freedom traffic and enjoys traffic rights in many countries which are recognized as being ungenerous in this respect. The reason is that KLM is backed by a very astute government that pulls no punches in its bargaining on behalf of the airline.

Furthermore, KLM itself engenders goodwill by its exceptionally fine passenger service, up-to-date equipment and friendly personnel. So too does Scandinavian Airlines System, which has many similar problems to those of KLM. These are sometimes simplified, but often complicated, by the three-nation ownership of the company.

Overseas Operations Profitable

• **Numerous foreign airlines** draw much of their profit—and in some cases incur most of their loss—from opera-

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tions to their overseas territories and colonies. The Belgian Congo, for example, is an important source of revenue to SABENA. The French airlines make a lot of money hauling traffic between France and points in French Africa.

Local service operations in overseas territories, however, are usually unprofitable. Air France's deficit is attributable to the large local service systems the company is required to maintain in Africa, Madagascar, the French West Indies and other overseas areas.

British policy has been to set up local airlines in the various overseas territories (British West Indian Airways, West African Airways and Aden Airways are representative examples) and this has relieved BOAC of directly carrying the losses incurred in these operations. BOAC thus has no short-haul services. The corporation continues to suffer from shortage of equipment and the repercussions from introducing new, unproved aircraft into service. Pending the introduction of the Britannia this summer, the Argonaut and Constellation are the mainstays of the routes east and south of London while transatlantic services are flown with Stratocruisers.

• **Both BOAC and BEA** continue to meet a small amount of indirect competition from the independent airlines. The latter operate non-pressurized aircraft and, on routes where IATA fares do not apply, often have lower tariffs than the nationalized corporations. Recently they have started to offer very low fares for combination air/surface travel between London and Paris. One of the most newsworthy events among the independents was Airwork Ltd.'s decision last December to abandon the transatlantic all-cargo service it opened earlier in the year.

In Britain and in France the independents and the nationalized carriers have achieved a relationship that is recognized by their governments—there is "a place in the sun" for both it seems, although some of the independents might well remark that the sun isn't very warm.

The outstanding example of controlled competition is in Australia where the government-owned Trans-Australia Airlines and the private-enterprise. Australian National Airways are allowed to compete on certain routes. Both make a profit and seem content.

Extensions Planned

Australia's overseas airline, Qantas Empire Airways, with a trunk-line fleet of Super Constellations, is hard at work trying to get U.S. permission to fly on from San Francisco to London. It already operates to London via India but many travelers, it contends, prefer to travel via the U.S. Hence the demand for the eastward extension of the Sydney-San Francisco route. Qantas will soon have competition from South African Airways on its route across the Indian Ocean from Australia to Johannesburg. SAA's Constellations, released from the Johannesburg-London service by the delivery of DC-7Bs, will be used to inaugurate the route this fall.

TURBO COMPOUND-POWERED Douglas DC-7 series aircraft are coming into service on international routes. Three international airlines (including South African Airways) are currently operating DC-7Bs and a dozen will start introducing the new-wing DC-7C. First of the latter will go onto PAA's transatlantic routes this summer.

IN SERVICE on most of the world's trunk routes, the Lockheed Super Constellation is still being delivered in quantity. Latest passenger version in production is L-1049G which is available with tiptanks to increase range. With the L-1649A version, to be delivered next year, Super Constellation's range will be further boosted.

• **Several other** major route extensions are in the works. Air-India International seems likely to extend its India-Europe route west to the U.S. within about a year. Portugal's TAP is about to open a Lisbon-Rio de Janeiro service. This has been in preparation for several months but has been delayed because of the company's feeling that tourist-class accommodations should be permitted on the route.

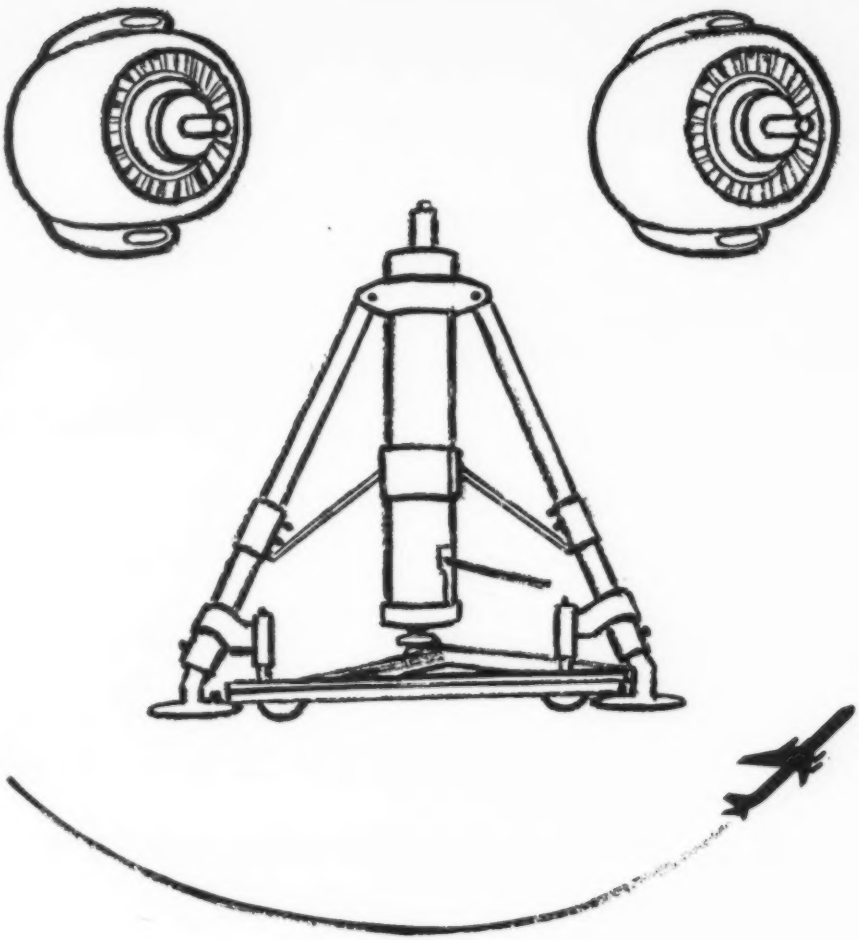
Europe-South America is the only remaining all-first-class route, although lower fares are permitted by IATA for services operated with DC-4s, DC-6s and Constellations than those for DC-6B and Super Constellation flights.

Canadian Pacific Airlines, which last year started its "polar" service from Vancouver to Amsterdam, is about to extend its Vancouver/Toronto-Mexico City-Lima route to Buenos Aires. Compania Cubana de Aviacion next month starts service to New York. Brazil's VARIG, which went into the "big time" last summer when it inaugurated operations to New York, is rumored to be planning to serve Europe, an expansion which undoubtedly would require additions to its present long-haul fleet of three Super Constellations.

Japan Air Lines' route extension program has not developed as quickly as anticipated—it will start service to Bangkok this summer but does not plan to fly west of that city for some time. Swissair and Italy's Linee Aeree Italiane plan to fly beyond the Middle East to India and Japan. Rumor has it that Philippine Air Lines will resume transpacific operations next year.

Several projected routes have a big "if" attached to them—if government approval is granted. This applies to SABENA's plans for a Brussels-Montreal San Francisco service, to KLM's desire to fly Amsterdam-Montreal-Los Angeles, and to Alitalia's projected Rome-London-Montreal operation.

• **New airlines** are scarcer than new routes. The only country where major formative developments are occuring is Austria where the KLM-backed Air Austria competes with the SAS-backed Austrian Airways. ◈◈◈



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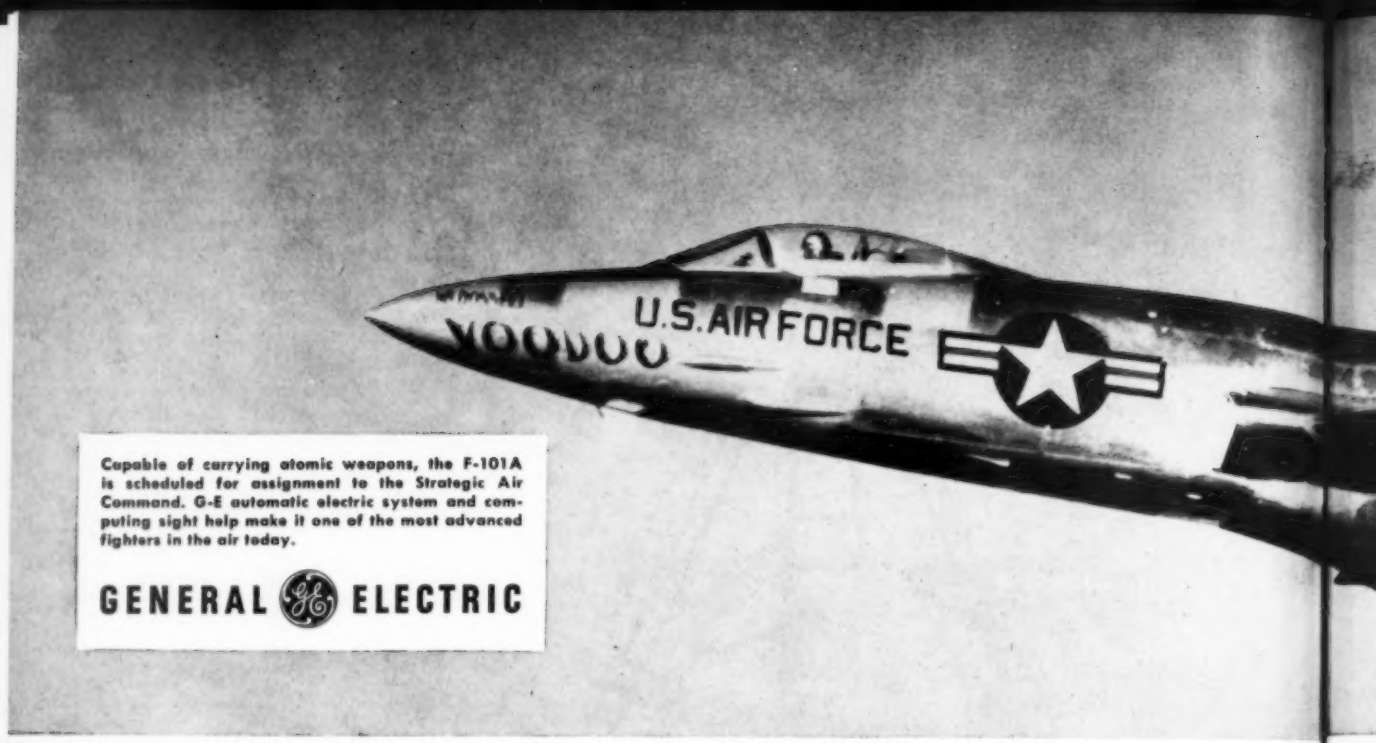

Capable of carrying atomic weapons, the F-101A is scheduled for assignment to the Strategic Air Command. G-E automatic electric system and computing sight help make it one of the most advanced fighters in the air today.

GENERAL ELECTRIC

How G-E Electric System and Gunsight Help

Main components of system include static voltage regulator and control panel.

Alternator receives test. General Electric tested the complete F-101A electric system prior to first airplane installation.

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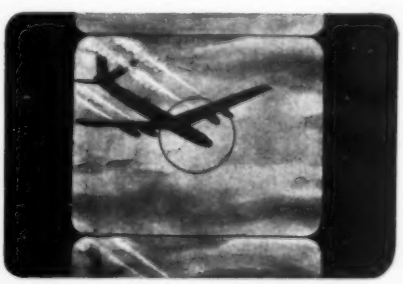
Pilot keeps enemy aircraft aligned in sight and fires when target is within range.



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Make F-101A a Potent SAC Fighter-bomber

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The Air Force's new supersonic jet fighter, the McDonnell F-101A Voodoo, is being equipped with a G-E computing sight and an automatic electric system which requires no pilot attention.

Designed with emphasis on simplifying the job of the pilot through use of automatic equipment, which includes a paralleling control furnished by another manufacturer, the G-E electric system begins operating as soon as the pilot starts the engine.

SPEEDS TAKE-OFF The control has only two toggle switches, which may remain "on" at all times, even when a fault develops. This eliminates a series of 10 pilot functions, and sharply reduces the time to become airborne.

With a generator that can operate at the high ram-air temperatures of supersonic flight, and a static voltage regulator that has no moving parts except the relays, the G-E system is designed for long life and reduced maintenance time. The control panel supplies the automatic control of start-up, shutdown, and maximum selective protection against ground fault, over- and under-excitation, and over- and under-voltage.

LIGHTWEIGHT GUNSIGHT HAS HIGH ACCURACY Giving the F-101A high fire-control accuracy for air-to-air gunnery is the G-E designed computing sight. It features lightweight and low maintenance due to its simple design. Automatic inputs assure the sight's accuracy for all modes of operation.

For more information on the General Electric power generating system, write Section 210-97, General Electric Co., Schenectady 5, N. Y. If you are cleared to receive classified material, see your nearest G-E Apparatus Sales representative for advantages of the computing gunsight. General Electric Company, Schenectady 5, N. Y.

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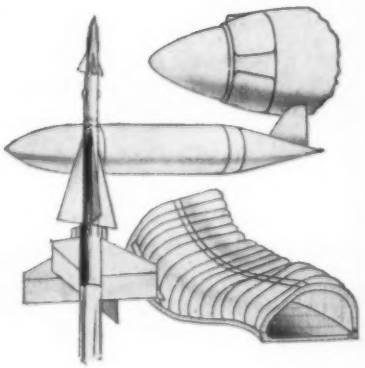

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BRITISH TRANSPORT INDUSTRY REPORT

Bristol, De Havilland, Vickers Still Lead in U.K.

Ministry of Supply moves to concentrate plant and design capacity on fewer projects; Vickers free for civil market.

By JAMES HAY STEVENS

LONDON—The United Kingdom's air transport industry is well spread around the 20 airplane manufacturing companies, with three specialist airliner producers in the lead: Bristol, De Havilland and Vickers. The other companies present actively building civil transports are Aviation Traders, Blackburn and General Aircraft, Handley Page, Hunting Percival and Scottish Aviation.

Early this year the new Minister of Supply, Reginald Maudling, took some action which was designed to concentrate plant and design capacity upon fewer projects. Primarily, this was for defense, but two of the major moves were of vital importance to the civil production picture.

• **Cancellation** of the order for half a dozen Vickers 1000 military jet transports removed a promising jetliner and the only Rolls-Royce Conway by-pass transport from the scene at one stroke. The second action was to cut back the Valiant jet bomber order somewhat, which will terminate that line some months earlier than originally foreseen.

The secondary effect of these actions was to release Vickers technicians and floor-space for development and production of the Vanguard medium-range turboprop transport. Maudling has hinted that the present government's view is to leave Vickers-Armstrongs clear of military contracts so as to concentrate all its efforts on its civil customers—which it is free to do at its own expense.

• **Government moves also** affect the civil position in other companies. Pressure is being brought to bear so that the next specification of the Royal Air Force Transport Command will be applicable also to a British Overseas Airways Corporation replacement type—jetliner or turboprop. Such an action would give the chosen manufacturer the financial advantages of a governmental prototype contract and a fair-sized initial production order. There is at present a specification out inviting proposals for a "1965 North Atlantic airliner."

Security restrictions on this project are very tight, but the most interested manufacturers are believed to be Avro, De Havilland and Handley Page. The specification seems to give wide latitude to the plane-builders, although rumor points to the Rolls-Royce Conway by-pass as the most favored powerplant.

Of the submissions, little is known, but it seems likely that Handley Page is offering a Conway-engined crescent-wing airplane with boundary-layer control for cruising drag reduction. Dr. G. V. Lachman's research on this system points strongly to its application, since it offers enormous possibilities for economy and range.

At the lower end of the scale, the government plans to order the Scottish Aviation Twin Pioneer bushliner for the Army's new mobile brigade—or riot squad.

This action should increase production facilities for this small, specialized transport.

• **Government backing,** while withdrawn from several helicopters, will be concentrated on (1) the Fairey Rotodyne intercity 40-seater with two Napier Elands (as turboprops for propulsion and as compressor drivers for the pressure-jet rotors at take-off) and (2) the Westland Wessex, a licensed version of the S-58 with Napier Gazelle shaft turbines.

Current Production

Vickers-Armstrongs is the big-time civil transport producer at present with the Viscount. The first turboprop airliner, with a three-year start in scheduled service, backed by the remarkable reliability of the Rolls-Royce Dart centrifugals, has made an unprecedented getaway for a U.K. transport in world market.

With 1953 and 1954 production levels at 22 each year, 1955 saw an increase to 48 (42 actual deliveries), while the current year is slated for 89—just over six a month from the Hurn plant and one a month from the supplementary Weybridge line. The 1955 production was half-a-dozen down on the target, mainly due to difficulties with the new floor-space built at Hurn.

• **Vickers-Armstrongs** recently com-

pleted a supplementary assembly hall at Weybridge, with another due to be finished before the end of the year for Viscount-Major 800 production.

As of mid-March, the 100th Viscount had been delivered—Capital Airlines' fifteenth — with a backlog of almost three hundred. Currently, delivery is around two years on new orders; less for the well-established 700 series and more for the 800, 810 and 840.

Due to progressive power development of the Rolls-Royce Dart, the original Viscount has evolved into three complementary series. The 700 has *not* been superseded. Rather it is the 40-59 seater for medium stages, 250-1,000 miles. The 800 series offers, primarily, increased capacity (achieved by a slightly lengthened fuselage and uprated Darts), 53 to 70 passengers.

The 810/840 version offers more speed and freedom from temperature accountability. The 810 will give 363 mph cruise at 17,000 ft., with normal takeoff at 5,000 ft. and 90°F airfields using the 2,100 ehp Dart RDa7, "derated" to 1,800-shp for sea level takeoff. The 840 will have 400 mph cruise with the 2,500 ehp RDa8. Delivery of these two later models is largely dependent upon the production position on the uprated Darts, but the first 810s are slated for Continental Air Lines in March 1958.

• **Vickers-Armstrongs'** George Edwards sees Viscount sales going on well into the 1960s. To supplement the Viscount family, the BEA-specified V900 Vanguard will be available by 1960. This airplane was the result of some 50 design studies in the closest co-operation between the manufacturer and the operator.

Under the driving force of Peter Masefield, the Vanguard emerged as a high-capacity passenger/freight short-hauler for the BEA route network. However, despite prime user requirements—the British European Airways order for 20 still stands alone despite an energetic Vickers sales drive—the Vanguard offers a paying load for stage lengths up to 2,500 miles.

Since this airplane was first announced jointly by Vickers and BEA, detail design work has advanced considerably. There has been some concentration upon insuring satisfactory fulfillment on the longer route segments—1,000 to 2,500 miles—in order to make the Vanguard truly competitive with the Electra and the Caravelle. Basically unaltered, the original wing area has been revised—visible by a trailing-edge kink—and the cockpit now has a more vertical windshield instead of a high-speed snout. Increased tank capacity will give this revised "international" Vanguard an initial gross of 135,000 lbs. against the 104,000 lbs. of the BEA version.

• **The Vanguard** starts life as an airliner with all the current turboprop lessons built into it—Vickers is still the only manufacturer in the world with turboprop airline experience to back design decisions. In particular, North American conditions and full temperature accountability will be met.

Vickers reports that the double-bubble fuselage, with 76-93 passengers above and freight below, is generally accepted as a sound layout. This shape is clean enough to allow 425 mph cruise speed with four Rolls-Royce Tyne turboprops—which will be delivering 2,470 ehp at that speed at 25,000 ft. The wing has been kept sufficiently thin to maintain a practical margin between the cruising speed and the buffet boundary, but will yet permit low approach speeds and the use of current regional airports.

Vanguard production is planned so the whole BEA order can be delivered rapidly in 1959, making it possible to bring subsequently ordered airplanes quickly into service. Vickers has its own resources at Weybridge, Wisley, Hurn, Eastleigh and South Marston to call upon, as well as a widely spread net of sub-contractors headed by Saunders-Roe, to fulfill its program.

The Bristol Offering

• **The Bristol Britannia** is due into service with BOAC this summer on the London-Johannesburg route. This is the basic airplane with a 114-ft. fuselage carrying 58 first class or 92 tourist passengers for a maximum payload of 25,000 lbs. for 3,730 miles SAR at 375 mph. Most airplanes on order have a 10-foot longer fuselage capable of holding 101 passengers or 87 passengers plus 825 cu-ft. of freight. The longer fuselage can be combined with additional wing tankage to give Atlantic capabilities (28,000 lbs., 4,940 miles at 406 mph). It is this version, the Britannia 310 (250), that now is most favored by operators. It has yet to be flight-tested.

The Bristol Proteus 755 turboprops, after a somewhat prolonged de-

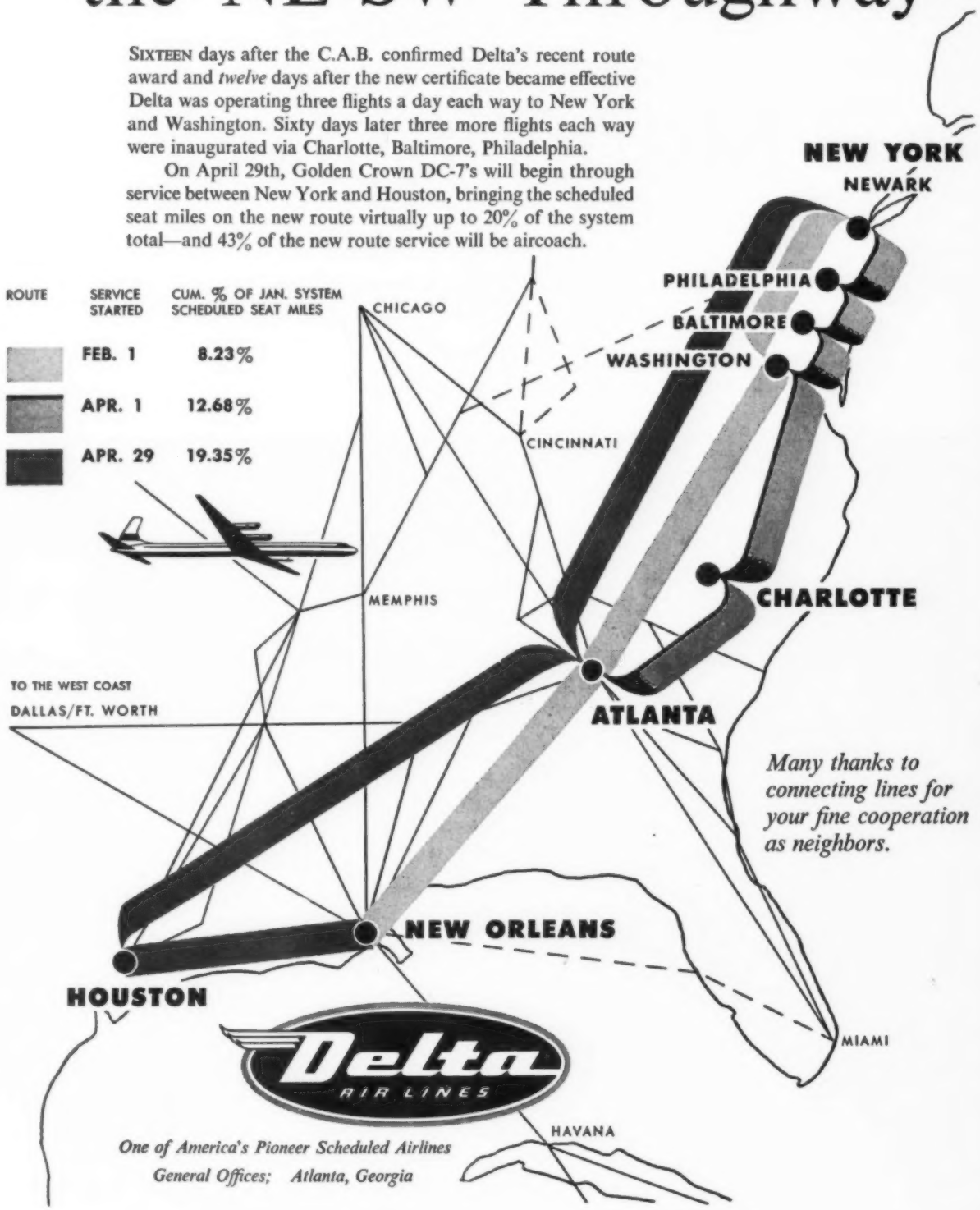
Bristol Britannia is now being delivered to BOAC for introduction in service this summer. Next year El Al Israel Airlines and Canadian Pacific Airlines will begin operations with the big British turboprop transport.

Scottish Aviation Twin Pioneer, powered by two Alvis Leonides engines, is shown with slotted extension flaps and slats in landing configuration. Its take-off and landing distances are exceptionally short.

DELTA'S timetable on the NE-SW Throughway

SIXTEEN days after the C.A.B. confirmed Delta's recent route award and *twelve* days after the new certificate became effective Delta was operating three flights a day each way to New York and Washington. Sixty days later three more flights each way were inaugurated via Charlotte, Baltimore, Philadelphia.

On April 29th, Golden Crown DC-7's will begin through service between New York and Houston, bringing the scheduled seat miles on the new route virtually up to 20% of the system total—and 43% of the new route service will be aircoach.



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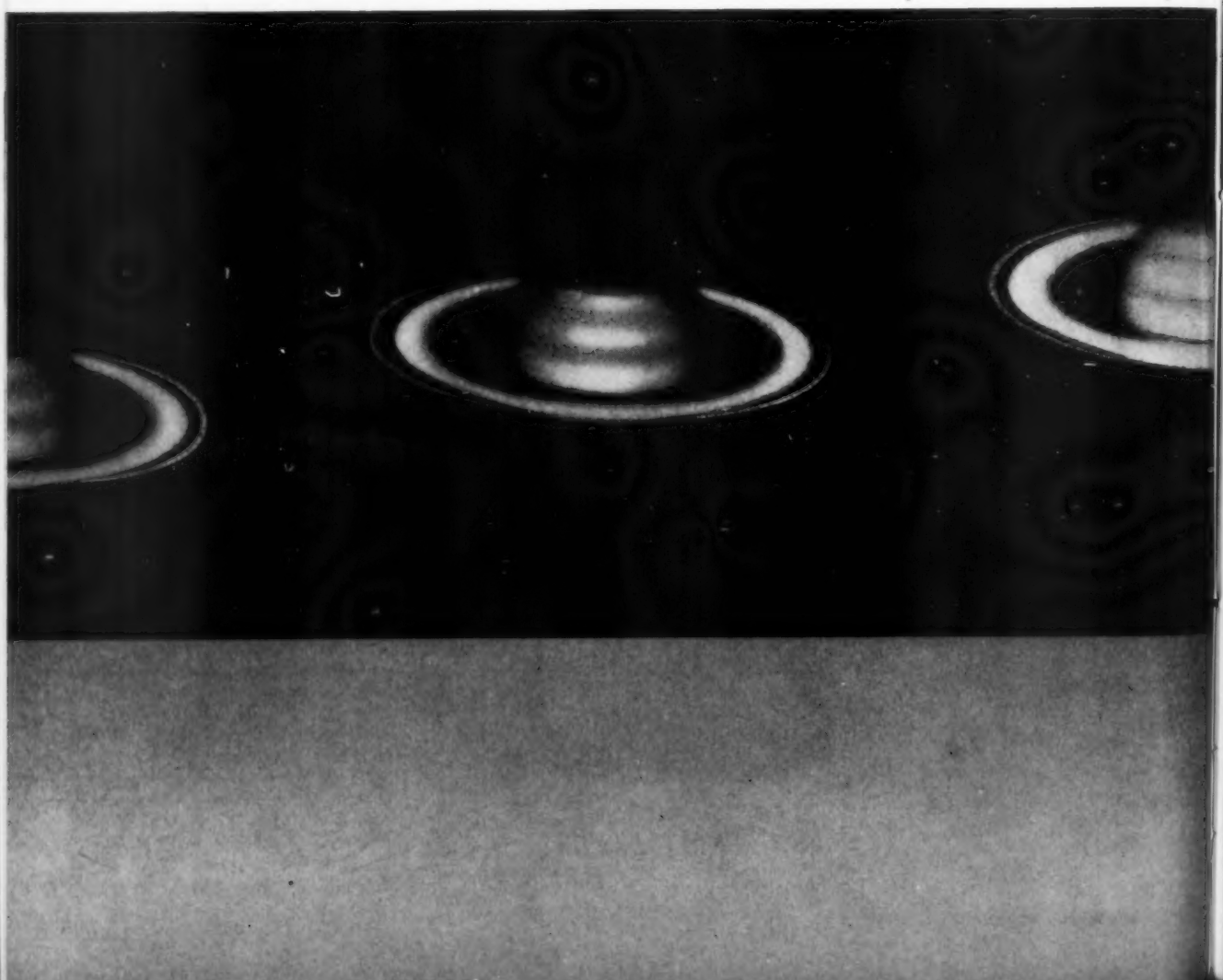

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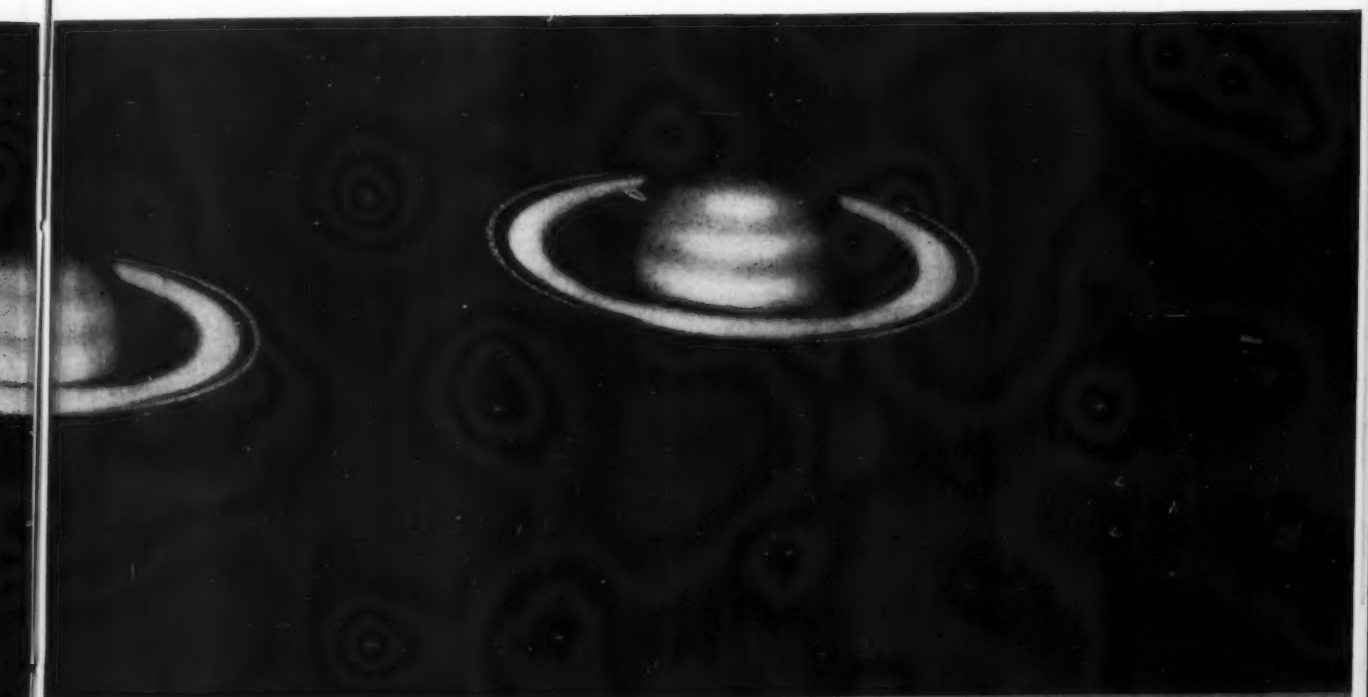

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velopment period, are now running very well and give 4,120 ehp at takeoff.

• **The loss** of a prototype and numerous other troubles during development, plus the addition of a tank fatigue-test requirement by the ARB, has made initial Britannia deliveries to BOAC late. Production planning is for two a month from Bristol by February 1958. This will be supplemented by the part-owned Short Brothers and Harland Ltd. at Belfast, Northern Ireland—where there is capacity for up to 50 annually. Fuselage component manufacture for both assembly lines is currently undertaken by Blackburn and General Aircraft at its Dumbarton, Scotland plant.

Fuselage diameter at 12 ft. is generous and provides very comfortable accommodation in any layout. Oval windows of ample size give a good view, although the entry door just aft of the wing removes the most pleasant seat row location. Flight controls are unique, being aerodynamically servo operated by trailing-edge tabs without direct connection. Such controls require many flight hours to develop, but are simpler to maintain than either power or manual controls.

• **For 1960,** Bristol is quoting the Britannia with BE-25 "constant-power" ("de-rated," or "supercharged," depending on who is selling them) turboprops. With a constant 4,000 shp for takeoff and climb out of any airfield in the world, a cruising power of 3,000 ehp *plus* at 36,000 ft. and a cruising specific of 0.385 lb./ehp/hr., these engines should increase the Britannia's range and speed—while the airline using it will have the advantage of a fully tried and bug-free airframe.

BE-25 replacement packs will be offered to owners of the current Britannias with a good trade-in value on the Proteus, since it can be reconditioned as a marine engine.

To follow the Britannia, Bristol is offering the Type 187, an Atlantic airliner with four BE-25s designed to cruise at 500 mph with 130 passengers.

De Havilland Enterprise

De Havilland offers the Comet 4 for 1958-1959, when BOAC will take delivery of its fleet of 19. In its latest form, the Comet will be a jetliner capable of operating at full load from any first-class airport. With its four 10,500 pst Rolls-Royce Avon turbojets and relatively low wing-loading, short takeoff, rapid first-stage climb and short landing run are features.

• **The Comet 4** will be an aerodynamic replica of the Comet 3, now flying. Structure will, however, have been entirely re-investigated—in fact, with the exhaustive official RAE investigation plus the current applied research program, the Comet 4 ought to have fewer unknowns than any other airliner ever built. A 30,000-hour *minimum* crack-free fatigue life on all the main structure is the target, coupled with elimination after that of any possibility of catastrophic failure.

The Comet 4 offers 60 first-class or 76 tourist seating, with capacity payload ranges of 16,720 lbs. for 2,900 miles and 19,300 lbs. for 2,700 miles respectively, with allowances and including a 50 mph headwind. Cruising speed is 500 mph at 40,000 ft.

• **With a single production line,** as envisaged for the BOAC order, De Havilland expects to complete Comet 4 delivery by early 1959. The BOAC Comets, therefore, still will be the first jetliners in airline service. Other orders will have to follow after this date.

Freighters

The Type 170 Freighter has been earning a small but steady income for Bristol since 1948. Production topped 200 a year back and continues on a small scale as orders keep trickling in. From time to time there is talk of a replacement, but without military capitalization the price of such an airplane would seem unlikely to justify any advance it could offer over the 170.

Now becoming available for the civil market, the Blackburn and General Aircraft Universal has a sound production line behind it established for the RAF Beverley army freighter.

The Universal is a simple airplane, robust and with minimum maintenance, and is the only civil one giving a 50,000-ton payload. In its latest form with four 3,150-hp Centaurus radials and at 143,000 lbs. gross, the Universal will carry its capacity payload for 650 miles, or can lift 10,300 lbs. for 3,000 miles.

"DC-3 Replacements"

The British offerings for a "DC-3 replacement"—if there is such an animal—are the Handley Page Herald and the Aviation Traders Accountant.

The Herald, with its four 870 hp Alvis Leonides Major powerplants, gives the operator pressurization, 1,000-mile range, 200-mph cruise and grass field capabilities with new, but conventional, piston engines. Seating is 36 to 44, with easy conversion for freight.

• **Handley Page** has had a good initial reception for the Herald in Australia. The prototype has been flying well and is being tested mainly from the small grass airfield at Handley Page's Reading plant.

Aviation Traders is a post-war company, an associate of the independent Air Charter, which has been doing a lot of sub-contract component manufacture—one of its steady items is the Bristol 170 centerplane. Although the company has been design-approved by

the Air Registration Board for some years and has done numerous major airliner conversions, the Accountant is its first airplane. It is a pressurized 36-44 seat low-wing monoplane powered by two Rolls-Royce Darts. The aim is to give full modern facilities with DC-3 grass field capabilities. The prototype is nearing completion at Southend Airport and should fly before the summer.

Feeders

Britain has always done well with smaller airliners suitable for company executive travel. De Havilland still finds the Dove a steady money-maker, without a direct competitor after nearly ten years. Over 500 have been sold and the larger derivative, the four-engined Heron, has already topped its first hundred. Both airplanes provide a tried airframe/engine/propeller combination, with after-sales service for everything from the one manufacturer.

• **Hunting Percival,** with the high-wing Prince and Pembroke, offers slightly higher all-around performance and a more spacious cabin. These are made possible by the use of two 550-hp Alvis Leonides radials. These airplanes have proved popular with military and executive customers and the production line has been going steadily for the past six years.

Newcomer to the feeder-liner market is the Scottish Aviation Twin Pioneer bushliner. Based on experience with the RAF's Prestwick Pioneer liaison monoplanes in Malaya, the new airplane is a real slow flier.

The Twin Pioneer provides a 14-16-passenger cabin, with a low step, one or two crew, high-wing shade factor and tailwheel gear. Two 550 hp Alvis Leonides power plants give 140/160 mph cruise and an initial en route climb of 880 ft./min. Disposable load is over 2 (short) tons, which is said to allow a full-load range of over 550 miles. Take-off to 50 ft. is 1,025 ft. and landing from the same height 880 ft. at the max. takeoff and landing weight of 13,500 lbs.

First production airplanes should start to roll from the Prestwick, Scotland, plant late this year.

Postscript

That is the British air transport scene as it is today and looking forward to the "sixties." Production methods in the U.K. are not those of the U.S., but the ability to deliver the airplanes and engines is there and an all-out drive is being made to keep the initial turbine transport lead despite the runaway big jet orders.

The other side of the picture would be for British manufacturers to break into the smaller, specialized transport markets—big freighters, branchliners and bushliners.

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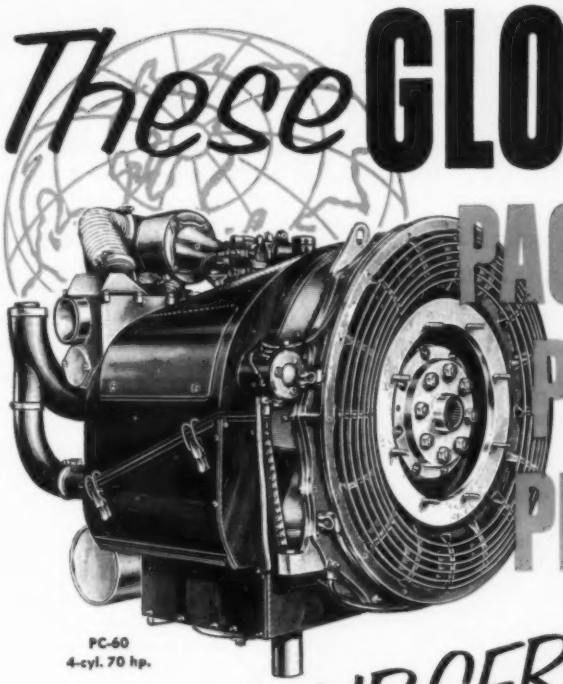
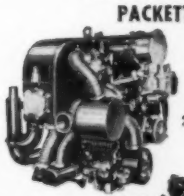
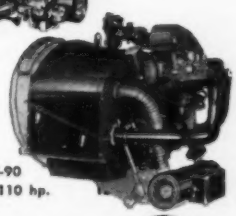


PC-60
4-cyl. 70 hp.

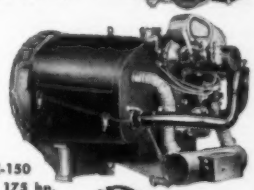
THESE ROUND OUT THE PACKETTE LINE



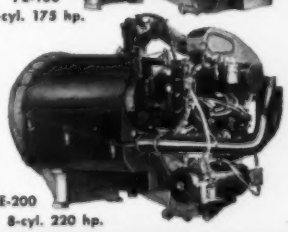
PC-30
2-cyl. 34 hp.



PE-90
4-cyl. 110 hp.



PE-150
6-cyl. 175 hp.



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DON'T COUNT OUT FRANCE

French Air Transport Builders in Good Shape

Manufacturers have models to offer in every category; twin-jet Caravelle attracting wide interest.

By JEAN-MARIE RICHE

PARIS—The French aircraft industry is producing transport aircraft in large quantities, despite statements that continue to be made by various aviation "authorities" outside France that it is good at building prototypes but poor on production. This may have been true a few years ago but today the record speaks for itself.

French plants are producing at this time quantities of single and multi-engine transport aircraft. These include the Pratt & Whitney R985-powered Max Holste Broussard and the SNECMA (Bristol-licensed) Hercules-powered SNCA du Nord Noratlas. Moreover, with the Caravelle of SNCA du Sud-Est, powered by Rolls-Royce Avon RA-26 or 29, the French industry has a good chance of remaining in the picture during the forthcoming jet age.

• **A close examination** of the various models currently in production, or planned for production, shows that France has models to offer in almost every category.

Perhaps the best known of all French transport aircraft at present is the SE-210 Caravelle, a medium-haul twin-jet transport that has been very much in the news since it made its first flight last May. It has logged about one hour of flying each day since then, an excellent performance for a prototype of this class. Air France has placed a firm order for twelve and has taken an option on twelve more.

A few weeks ago, the Soviet Embassy in Paris indicated that Aeroflot, the Russian airline, was interested in acquiring an initial batch of twenty Caravelles. Several leading airlines in the western world are also seriously studying this aircraft. The Caravelle is unusual in many respects and notably in the location of its engines in pods at the rear of the fuselage. It has a maximum take-off weight of 90,400 lbs. and cruises at 472 mph. Maximum range, with a payload of 8,800 lbs. is 2,765 miles. With a payload of 15,400 lbs., range is 1,865 miles. The Caravelle can accommodate up to seventy passengers plus 5,500 lbs. of cargo.

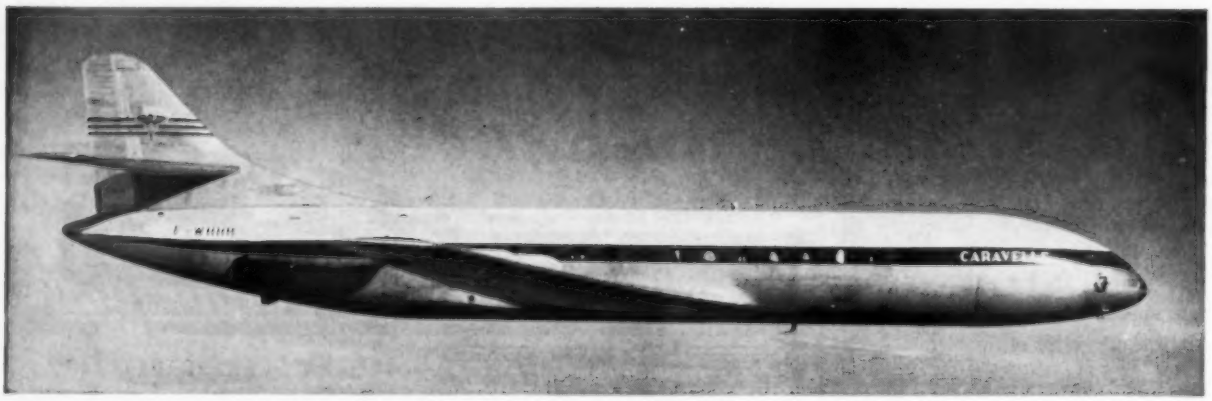
• **Because of** the location of the engines in the extreme rear of the fuselage, noise level should be extremely low. In fact, the Caravelle should be about the most comfortable aircraft ever built from the passenger aspect. Another advantage of the location of the power plant is in safety. Being far removed from the fuel tanks, there is a lower risk of fire in the event of a crash. Moreover, turbine blade failures would occur in an area where passengers could not be harmed.

Many people wonder how the Caravelle behaves with one of its engines inoperative on take-off. Flight tests have shown that it continues to climb and, because the thrust line is close to the center of gravity, stability is virtually unaffected.

• **Air France** will soon receive the first prototype of the Caravelle for a 500-hour service test. The national airline is backing the transport 100 per cent, a novelty for the French aircraft industry. The second prototype is due to fly any day now, after which SNCASE will immediately start production of a batch of 50 aircraft.

The first production models will be delivered to Air France at the end of 1958. An order placed now could be filled late in 1959. By 1960, the com-

Firm orders have been placed for 215 Broussards. The Max Holste company has built four prototypes and 27 pre-production aircraft. Powerplant is the P&W R-985.



SNCA du Sud-Est's Caravelle is pride of French aircraft industry. Two prototypes have been built and 12 are to be produced for Air France.

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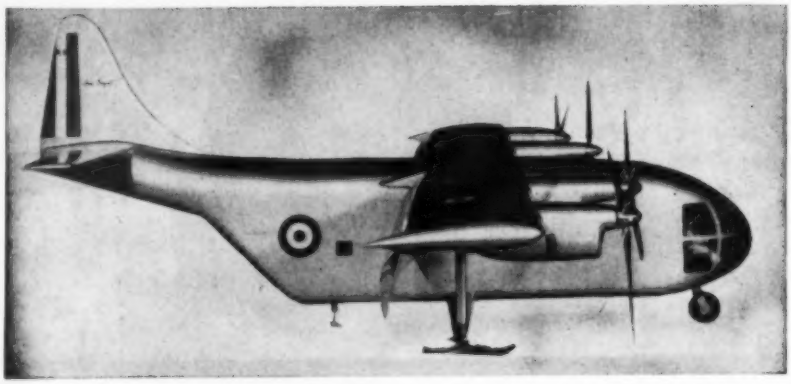

Breguet's 941 Integral is an STOL aircraft design using four 800-hp Turbomeca turboprops as powerplants. Company is building wing for a half-scale model of 30,000-lb. gross 941.

Twelve Breguet Deux Ponts have logged more than 40,000 hours with Air France. The double-deck transport uses four P&W R-2800s. A new military version is being built for the French Air Force Transport Service.

Latest version of Nord Noratlas is the 2502, equipped with P&W R-2800 engines (instead of standard SNECMA/Bristol Hercules) and Turbomeca Marbore II tip-mounted auxiliary jets. 100th Noratlas was delivered recently and more than 200 are to be built.

pany should be turning out Caravelles at the rate of four a month. Latest price for the aircraft is $1,750,000 (without seating accommodations).

SNCASE has already developed firm plans for new versions of the Caravelle. Operators already have the choice between the 10,000-lb. static thrust Avon RA-26 and the 10,500-lb. RA-29. At a latter stage, the Conway bv-pass engine may be used in a "Supe. Caravelle" which would have larger capacity than the present model as well as greater speed and economy.

• **The first** French aircraft of post-war design used by Air France is the Breguet Deux Ponts. Powered by Pratt & Whitney R-2800 CA-18 engines, this very large transport (113,800 lbs. gross weight) cruises at 230 mph and has a maximum range of 2,000 miles. Air France bought 12 of the 763 version and the aircraft is now going back into production in a 765 military version, of which 15 are to be built for the French Air Force Transport Service.

Three of the early model 761s are already in service with the French Air Force and have proved the value of the model for carrying heavy equipment (eight jeeps and eight tons of equipment; six 105-mm howitzers with 4.2 tons of ammunition; one AMX tank with 3.2 tons of ammunition; or three lightweight fighters).

In Air France service, the Deux Ponts has logged over 40,000 hours of flying, mainly in the Mediterranean area. It carries 107 passengers, first class being accommodated on the upper deck and third class on the lower. Price of the Deux Ponts is currently quoted at $1,200,000 with delivery two years after receipt of order.

Breguet is also working on a smaller, less conventional type of aircraft—the 941, a VTOL project built around four 800-hp Turbomeca turboprops and using a blown wing, with the entire wing placed in the slipstream of the propellers. Take-off weight of the 941 is 30,000 lbs.

• **France's principal** production transport today is the Nord Noratlas, which is not unlike the Fairchild Flying Boxcar. The company has just built its 100th aircraft of this type, which is a twin-boom, all metal model with a maximum gross weight of 45,423 lbs. Although primarily designed for military units, the Noratlas has been supplied to the French independent airline UAT. At the moment, SNCA du Nord has orders for 160 from the French Air Force and has delivered about 100.

The Noratlas will become the standard cargo transport of the German Air Force and will be built under license in Germany. Price of the aircraft is about $515,000, with delivery scheduled about eight months after receipt of the order. A new version of the aircraft, designated type 2503, is equipped with Pratt & Whitney R-2800 CB-17 engines instead of the British-designed Hercules.

• **The Noratlas,** at maximum gross weight, takes off with a run of 2,660 ft. or 3,090 ft. to clear a 50-ft. obstacle. On landing, it stops 2,690 ft. after having cleared the 50-ft. obstacle. Top speed at 5,000 ft. is 193 mph.

Performance of the aircraft can be improved by fitting Marbore II auxiliary jets at the wing tips. Jean Combard, Manager of UAT, says that the use of these auxiliary jets increases payload by about one ton. Use of the aircraft in Africa has opened new fields of cargo operations to the airline. Performance under tropical conditions has been very impressive, he says. A re-order of Noratlas by UAT is highly probable.

Broussard Air Force Choice

• **France's other** production aircraft is the single-engine Broussard, made by the Max Holste company. Powered by a 450-hp Pratt & Whitney R-985, it is comparable in many respects to the Beaver or Otter of De Havilland, Canada. The French Air Force has just

taken delivery of the first production aircraft of a large order.

The Broussard was designed with both civil and military requirements in mind and makes an excellent utility transport, particularly for use in tropical conditions. As a transport it can carry six passengers. It takes off in 607 ft. at full load and clears a 50-ft. obstacle in 1,066 ft. Landing distance after clearing 50 ft. is 787 ft., of which 300 ft. is the ground run. The rugged landing gear makes the aircraft suitable for use on almost any type of terrain. Price with standard equipment is quoted at $39,500, with delivery scheduled five to six months after receipt of the order. The Max Holste company is developing a twin-engine version of this rugged transport.

• **The Hurel Dubois** HD-32 transport, which promised so well as a DC-3 replacement two or three years ago, is still without any production orders. Testing program of the prototypes has taken much longer than initially expected. Further delays were caused when the French Navy asked for special modifications with a view to ordering an anti-submarine version of the aircraft (HD-35). As yet, however, there are still no firm orders for either the commercial or the naval version although the French National Geographical Institute has bought four of a survey version (HD-34).

Production of the HD-32 by SNCA du Sud-Est is unlikely to materialize unless interest in the aircraft increases sharply in the near future. Since the HD-32 first appeared, the Handley Page Herald and the Fokker F-27 have diverted much interest from the French model. Most observers feel sorry for the Hurel Dubois company, which had a good idea but was handicapped in reaping the fruits of it. It is an example of how difficult it is for a manufacturer to succeed if it doesn't have anything more than a prototype shop and no production facilities. Latest price for the HD-32 is $515,000 with delivery scheduled in 1958.

This brief review of the French transport industry would be incomplete without mention of French work in the helicopter field. SNCA du Sud-Est has an order for some 200 Alouette 5-passenger models and plans to build up to 15 a month within a year's time. Price of this model is $54,000. SNCA du Sud-Ouest is also building large quantities of its light Djinn helicopter for the French government and foreign customers and is offering quick deliveries. A model derived from the Alouette—the SE-316—is currently being built. It is a clean design, resembling to some extent a development of the S-56, and powered by three Turbomeca turbine engines.

◈◈◈

United specifies Skydrol for entire new jet fleet

In one of the largest commercial jet orders ever placed with one manufacturer, United Air Lines recently purchased thirty Douglas DC-8s for delivery starting in 1959. To help assure maximum operating safety and efficiency for these jets, United specified a fire-resistant Skydrol fluid *for the hydraulic system* (Skydrol 500).

The same advantages that make Skydrol the preferred fire-resistant synthetic hydraulic fluid in piston engine aircraft, also make it superior for use in jets. Skydrol is the only *fire-resistant fluid* approved by the C. A. A. — outlasts, *outperforms* petroleum fluids . . . providing higher lubricity for longer hydraulic component life.

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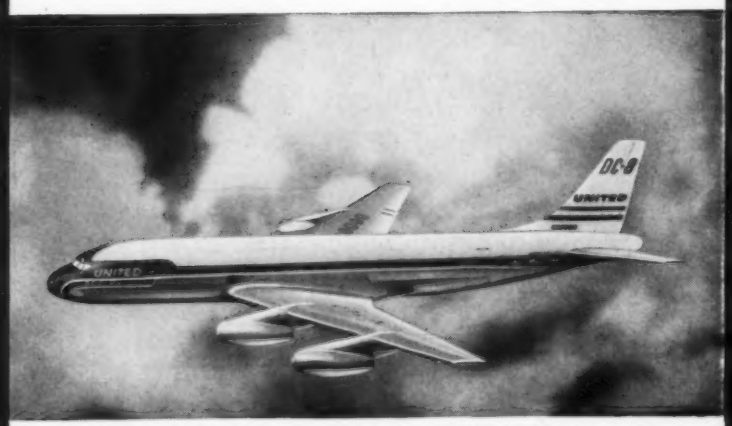

THE DOUGLAS DC-8, powered by four P&W J-57 engines, will carry 112-140 passengers and 7000 lbs. of freight over 3000 miles non-stop at speeds up to 575 m.p.h. Seat-mile costs of operating these jets may even be less than latest piston types.

34 MAJOR AIRLINES NOW USING SKYDROL

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PAL	WESTERN	CONTINENTAL
CMA	ALITALIA	FLYING TIGER
KLM	SWISSAIR	PAN AMERICAN
LAN	UNITED	CANADIAN PACIFIC
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Traffic Ratings, U.S. Scheduled Airlines, 1955

Rank	Airline	Revenue Passengers
1.	American ..	7,369,209
2.	Eastern	6,740,507
3.	United	5,589,529
4.	TWA	4,047,584
5.	Capital	2,570,170
6.	PAA	2,202,056
7.	Delta	2,151,208
8.	Braniff	1,673,648
9.	Northwest ..	1,344,370
10.	National ...	1,310,603
11.	Western	1,092,578
12.	Continental .	602,466
13.	Northeast ..	583,151
14.	Colonial ...	452,095
15.	N. Central..	431,324
16.	Hawaiian ..	417,457
17.	Piedmont ..	362,233
18.	Allegheny ..	349,673
19.	Mohawk ...	283,397
20.	Southwest ..	268,618
21.	Ozark	247,031
22.	West Coast .	200,945
23.	Trans-Pac. .	199,348
24.	Frontier ...	176,922
25.	Southern ..	170,589
26.	Trans-Texas.	157,859
27.	Caribair	142,332
28.	Panagra	137,591
29.	Lake Central.	114,148
30.	Bonanza ...	107,115
31.	Central	94,282
32.	Pac.Northern	92,458
33.	Ellis	56,286
34.	Pioneer	45,049
35.	Alas. Coast .	44,102
36.	Alaska	41,522
37.	N.Y. Airways	24,569
38.	Wien Alaska	23,390
39.	Cordova	18,048
40.	N. Consol. ..	15,594
41.	Los Angeles	5,183
42.	Reeve	4,729
43.	Byers	1,964
44.	Aerovias ...	.....
45.	Flying Tiger	.....
46.	HAS	.....
47.	Riddle	.....
48.	Slick	.....
	TOTAL ..	41,962,732

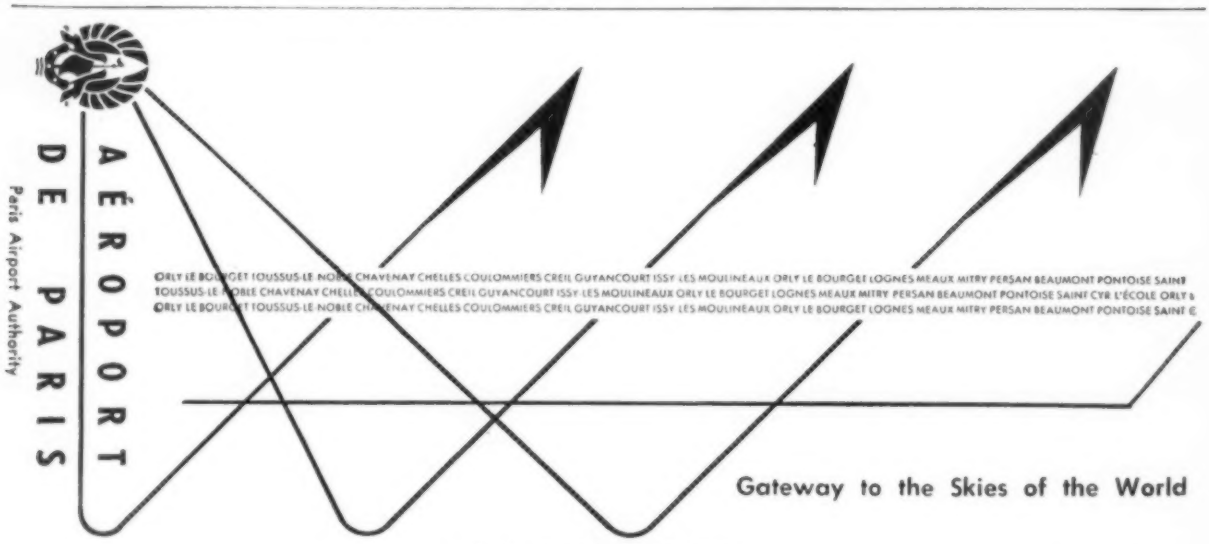
Rank	Airline	Revenue Passenger Miles (000 omitted)
1.	American ..	4,360,299
2.	United	3,986,428
3.	Eastern	3,598,044
4.	TWA	3,502,931
5.	PAA	2,817,993
6.	Northwest ..	1,019,306
7.	Delta	1,011,462
8.	National ...	908,168
9.	Capital	803,923
10.	Braniff	684,279
11.	Western	514,677
12.	Continental .	222,253
13.	Panagra	164,329
14.	Colonial ...	130,318
15.	Northeast ..	116,728
16.	Pac. Northern	76,110
17.	Piedmont ..	70,043
18.	N. Central .	67,667
19.	Hawaiian ..	57,255
20.	Allegheny ..	55,983
21.	Southwest ..	52,345
22.	Mohawk ...	50,954
23.	Frontier ...	46,290
24.	Ozark	37,617
25.	Trans-Texas.	35,975
26.	West Coast .	35,110
27.	Southern ..	28,845
28.	Trans-Pac. .	25,469
29.	Bonanza ...	23,575
30.	Alaska	17,190
31.	Lake Central	16,995
32.	Central	15,518
33.	Pioneer	11,705
34.	Caribair	11,042
35.	Wien Alaska	9,280
36.	N. Consol. ..	4,331
37.	Alas. Coast..	4,120
38.	Ellis	3,179
39.	Cordova	3,105
40.	Reeve	2,425
41.	N.Y. Airways	492
42.	Byers	220
43.	Los Angeles.	156
44.	Aerovias ...	.....
45.	Flying Tiger	.....
46.	HAS	.....
47.	Riddle	.....
48.	Slick	.....
	TOTAL ..	24,604,234

Rank	Airline	Mail Ton-Miles
1.	PAA	29,719,533
2.	United	26,377,773
3.	TWA	21,903,202
4.	American ..	18,252,265
5.	Northwest ..	15,008,726
6.	Eastern	10,868,378
7.	Delta	3,383,893
8.	Capital	3,275,107
9.	National ...	3,228,378
10.	Western ...	2,621,118
11.	Braniff	2,218,427
12.	Pac. Northern	917,797
13.	Continental .	754,951
14.	Alaska	544,178
15.	Panagra	512,113
16.	Wien Alaska	345,513
17.	N. Consol..	219,967
18.	N. Central ..	203,208
19.	Frontier	194,734
20.	Colonial ...	171,603
21.	Trans-Texas.	152,935
22.	Northeast ..	140,853
23.	Piedmont ..	135,488
24.	Reeve	129,771
25.	Southern ..	98,025
26.	Allegheny ..	90,232
27.	Ozark	81,326
28.	Southwest .	80,198
29.	Mohawk ...	53,918
30.	Los Angeles.	52,454
31.	Alas. Coast..	52,427
32.	Central	49,933
33.	West Coast .	47,839
34.	Hawaiian ..	45,883
35.	Bonanza ...	41,069
36.	Pioneer	39,491
37.	Cordova	36,010
38.	HAS	28,458
39.	Lake Central	28,018
40.	Ellis	26,834
41.	N.Y. Airways	15,618
42.	Caribair ...	13,107
43.	Trans-Pac. .	13,012
44.	Byers	7,704
45.	Aerovias ...	.....
46.	Flying Tiger	.....
47.	Riddle	.....
48.	Slick	.....
	TOTAL ..	142,181,467

Rank	Airline	Express Ton-Miles
1.	United	12,791,971
2.	American ..	11,067,191
3.	TWA	8,407,014
4.	Eastern	5,584,454
5.	Northwest .	2,853,406
6.	Capital	2,830,057
7.	Delta	2,697,462
8.	Braniff	1,397,716
9.	Alaska	1,380,450
10.	Western ...	856,390
11.	National ...	749,884
12.	Continental .	301,418
13.	N. Central..	298,227
14.	Allegheny ..	193,414
15.	Northeast ..	186,290
16.	Ozark	162,240
17.	Southern ..	133,941
18.	Lake Central	130,438
19.	Piedmont ..	123,221
20.	Frontier ...	86,109
21.	Colonial ...	85,016
22.	Mohawk ...	75,659
23.	Trans-Texas.	72,718
24.	Southwest ..	58,002
25.	Alas. Coast..	42,925
26.	Bonanza ...	25,033
27.	Pioneer	24,249
28.	West Coast .	23,756
29.	Central	20,367
30.	Los Angeles.	17,861
31.	N.Y. Airways	14,072
32.	N. Consol. .	2,423
33.	Aerovias ...	.....
34.	Byers	.....
35.	Caribair	.....
36.	Cordova ...	.....
37.	Ellis	.....
38.	Flying Tiger	.....
39.	Hawaiian ..	.....
40.	HAS	.....
41.	Pac. North..	.....
42.	PAA	.....
43.	Panagra	.....
44.	Reeve	.....
45.	Riddle	.....
46.	Slick	.....
47.	Trans-Pac. .	.....
48.	Wien Alaska	.....
	TOTAL ..	52,713,374

Rank	Airline	Freight Ton-Miles
1.	American ..	69,482,640
2.	PAA	68,876,905
3.	Slick	52,416,153
4.	Flying Tiger	49,882,372
5.	United	40,280,873
6.	TWA	32,845,903
7.	Eastern	14,959,136
8.	Riddle	14,314,808
9.	Northwest .	13,487,651
10.	Delta	7,370,796
11.	Aerovias ...	5,880,055
12.	Wien Alaska	4,869,827
13.	National ...	4,770,147
14.	Braniff	4,391,613
15.	Capital	3,998,656
16.	Pac. North..	3,551,947
17.	Alaska	2,794,968
18.	Panagra ...	2,683,903
19.	Western ...	2,350,978
20.	Hawaiian ..	1,537,997
21.	Continental .	1,290,998
22.	Frontier ...	639,888
23.	N. Consol. .	635,905
24.	Cordova	536,739
25.	Northeast ..	397,825
26.	Colonial ...	345,840
27.	Reeve	337,013
28.	Piedmont ..	161,013
29.	Trans-Texas.	159,077
30.	Southwest ..	129,737
31.	Trans-Pac. .	113,038
32.	Mohawk ...	83,969
33.	West Coast .	75,777
34.	Colonial ...	56,779
35.	Central	56,508
36.	Bonanza ...	53,316
37.	Pioneer	36,327
38.	Ellis	31,213
39.	Caribair ...	30,639
40.	Byers	10,556
41.	Alas. Coast...	8,139
42.	N.Y. Airways	5,331
43.	Allegheny ..	.....
44.	HAS	.....
45.	Los Angeles.	.....
46.	N. Central..	.....
47.	Ozark	.....
48.	Southern ..	.....
	TOTAL ..	405,803,390

[1] Continental Air Lines and Pioneer Air Lines merged effective April 1.
NOTES: In above tabulation domestic and international operations of companies have been combined.
Above figures include both scheduled and non-scheduled operations.
Mail ton-miles include air parcel post and first-class mail carried by air.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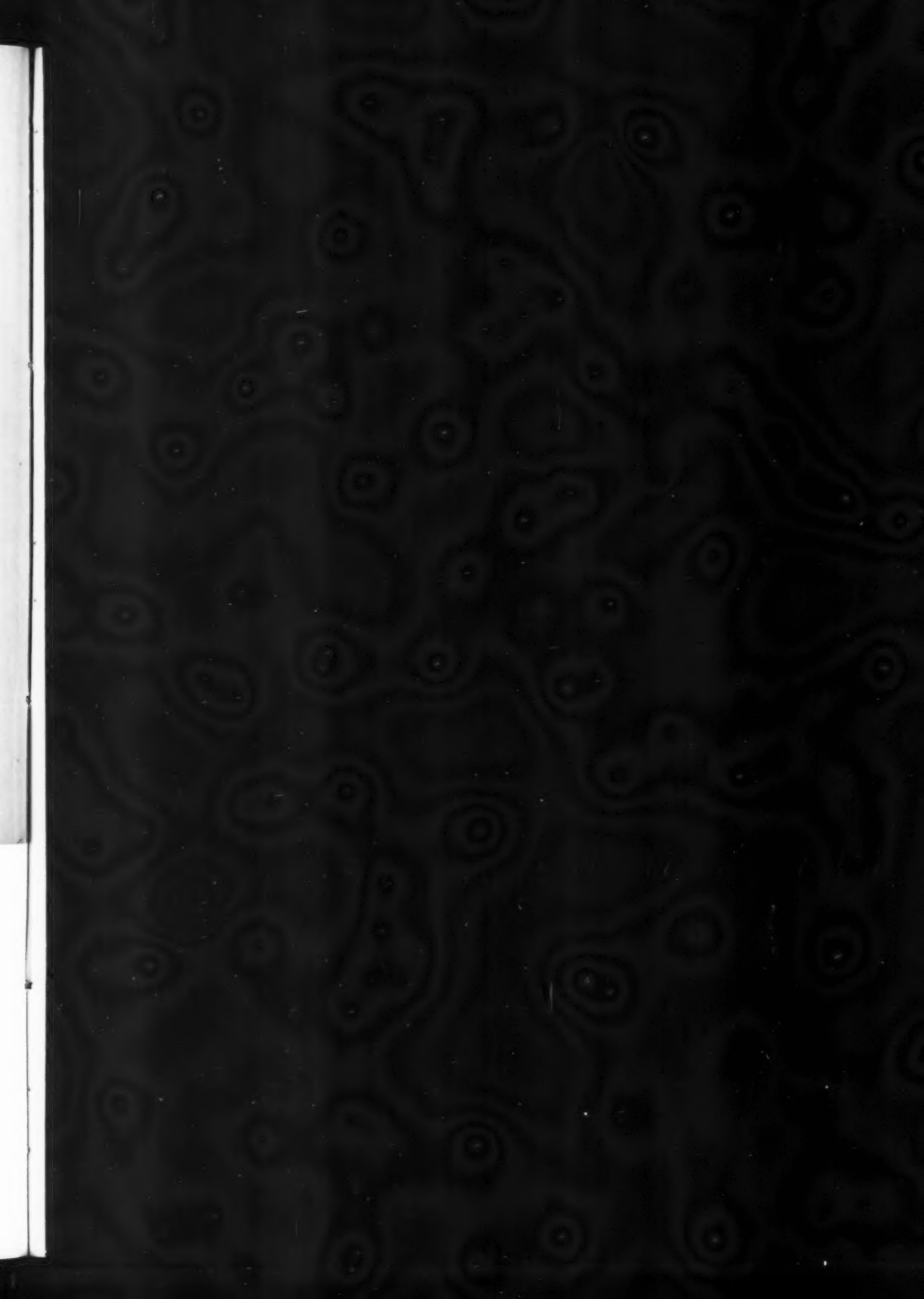

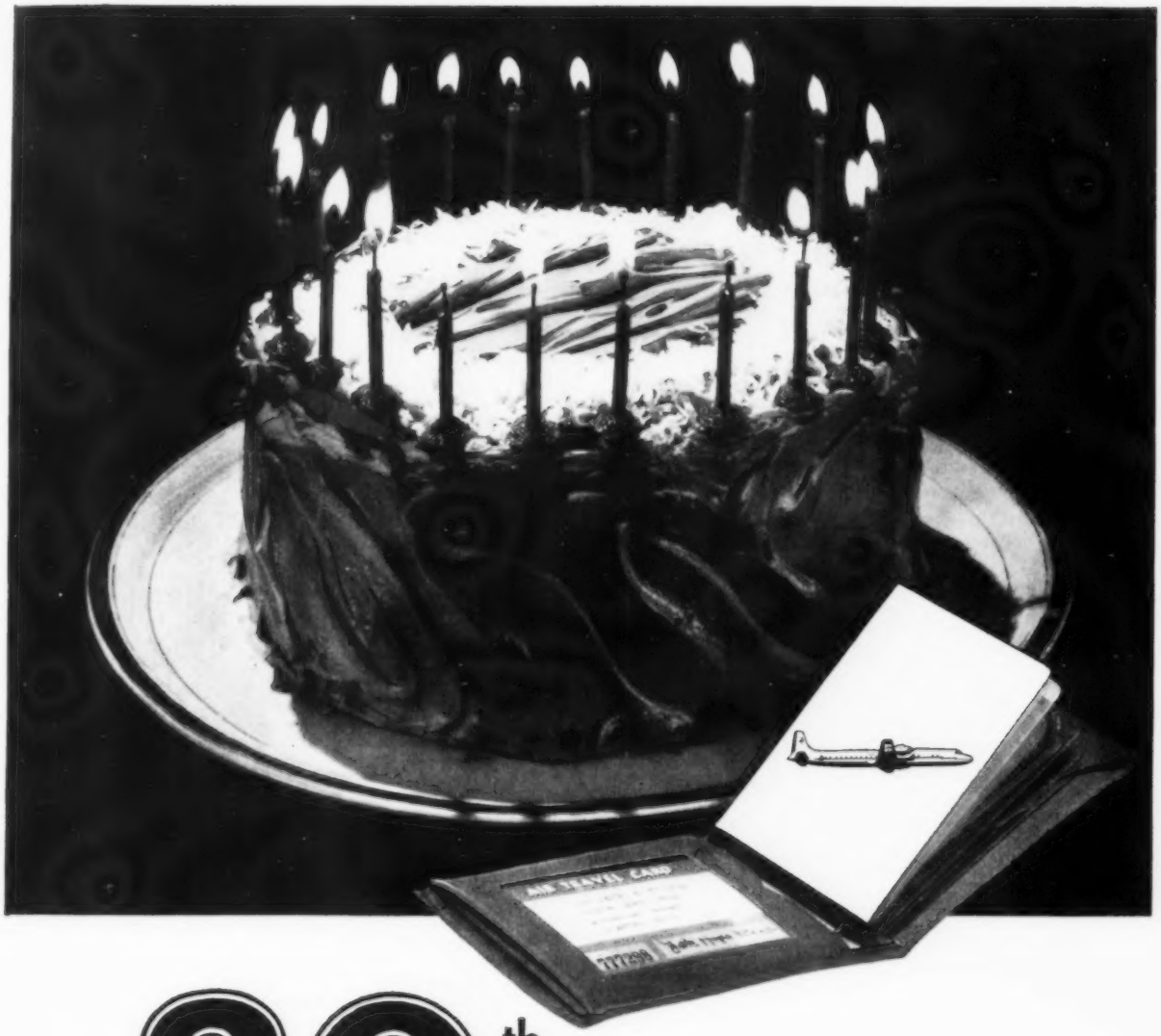

20th anniversary of an idea that's earned a lot of credit

In line with its pledge to provide the finest in air travel, American has been responsible for many of the industry's most important innovations. Of these, one of the most successful was the Air Travel Plan which was first introduced by American in 1936 to extend credit to air travelers.

It came as a great convenience to businessmen and developed a new acceptance of air travel among those firms who had not previously encouraged their personnel to fly. Today the air credit card is so widely used that at the close of 1955 there were 68,000 business firms using the plan throughout the United States and 722, 310 individual cardholders who purchased over $300,000,000 worth of air transportation during the year.

American Airlines is proud to have pioneered the Air Travel Plan which has contributed so substantially to the growth of air transportation.

AMERICAN AIRLINES

Americas Leading Airline

Selected Airline Expenditures

Company	Total Assets 1955	Total Assets 1954	Shop and Servicing Supplies 1955	Shop and Servicing Supplies 1954	Passenger Food Expense 1955	Passenger Food Expense 1954	Other Passenger Supplies 1955	Other Passenger Supplies 1954
Aerovias Sud	$ 873,781	$ 552,340	$ 1,141	$ 2,524	.....	.....	.....	.....
Alaska	2,481,816	2,516,551	23,312	20,857	$ 54,265	$ 76,495	$ 8,261	$ 7,573
Alaska Coastal	776,558	678,128	15,361	11,231	.....	.....	44	105
Allegheny	2,983,250	1,749,037	30,763	32,493	6,250	879	4,954	4,699
American	203,012,345	174,703,081	1,395,768	1,362,062	6,431,057	5,176,343	1,185,829	1,141,874
Bonanza	1,274,036	781,206	13,389	8,310	5,635	4,352	6,166	3,713
Braniff	31,700,762	35,280,441	240,993	257,320	1,467,413	1,185,360	232,849	167,889
Byers	103,448	100,759	494	592	.....	.....	45	49
Capital	29,070,053	25,085,707	332,524	296,004	1,477,518	1,228,879	262,541	238,787
Caribbean	939,273	760,267	7,527	8,997	2,638	2,772	1,159	2,301
Central	1,163,715	864,487	11,544	11,583	5,963	4,914	4,275	2,506
Colonial	3,942,873	3,605,656	41,080	40,685	243,262	242,200	67,654	72,708
Continental*	12,278,574	10,309,012	89,322	80,853	316,525	267,096	40,503	25,844
Cordova	391,085	396,493	5,206	1,604	1,937	1,591	1,112	838
Delta	54,309,650	50,568,224	535,829	411,529	1,539,267	1,410,866	183,554	168,415
Eastern	156,893,772	133,772,151	962,028	713,855	4,373,450	2,884,241	790,850	470,366
Ellis	712,084	630,531	3,431	871	.....	.....	.....	.....
Flying Tigers	18,582,565	16,268,995	89,300	67,975	64,650	59,772	6,678	5,533
Frontier	1,696,215	1,576,984	40,288	29,106	21,026	21,494	21,156	18,993
Hawaiian	3,933,383	4,824,378	31,147	27,510	6,168	.....	19,059	11,919
Helicopter A. S.	536,298	488,534	8,507	7,297	.....	.....	.....	.....
Lake Central	983,078	820,291	839	1,303	5,934	4,698	1,700	2,713
Los Angeles	990,206	790,540	2,136	2,330	.....	.....	3	.....
Mackey	1,560,383	486,976	9,915	not filed	2,200	not filed	1,270	not filed
Mohawk	3,089,671	2,063,505	29,374	33,720	3,571	990	2,574	963
National	37,599,808	37,230,102	279,638	243,691	1,027,131	825,980	160,679	132,233
New York Airways	2,596,107	2,588,690	7,529	6,136	.....	.....	.....	506
North Central	2,900,073	2,525,053	22,334	12,297	23,073	2,651	5,955	1,898
Northeast	7,181,426	6,405,256	75,821	63,527	184,323	141,519	36,014	33,475
Northern Consol.	1,239,522	1,295,594	13,774	23,641	6,991	9,366	2,114	2,808
Northwest	51,374,528	39,036,304	441,775	386,826	1,335,133	1,046,786	309,345	413,612
Ozark	2,097,436	1,906,450	28,434	23,315	3,072	2,469	6,271	3,920
Pac. Northern	3,371,088	3,647,520	31,660	26,202	151,206	135,288	17,401	11,628
Panagra	25,849,333	119,335,123	56,321	44,702	358,408	313,994	185,765	146,945
Pan American	254,146,120	230,646,650						
Alaska	.....	.....	23,385	23,536	170,826	177,997	55,510	48,628
Atlantic	.....	.....	361,224	364,147	1,663,059	1,304,028	722,593	547,247
Latin American	.....	.....	730,869	844,847	1,445,246	1,204,241	493,396	456,200
Pacific	.....	.....	312,122	426,456	941,511	699,087	287,682	329,463
Non-divisional	.....	.....	.....	.....	.....	.....	.....	.....
Piedmont	2,930,372	2,949,234	13,337	8,596	19,897	20,657	16,328	12,725
Pioneer*	2,640,845	1,381,485	9,213	12,954	27,237	44,672	3,128	8,104
Reeve	454,643	420,656	1,560	1,096	4,968	4,387	867	621
Resort	2,601,385	2,550,317	8,163	11,928	17,638	85,553	1,600	6,938
Riddle	5,696,607	1,075,517	15,300	10,034	.....	.....	.....	.....
Slick	7,795,672	5,984,271	162,864	104,991	28,255	9,690	7,953	1,074
Southern	1,522,007	1,217,733	28,187	30,100	8,063	4,185	5,294	3,606
Southwest	2,958,067	2,724,744	26,377	21,379	105	245	2,232	1,912
Trans Pacific	620,967	661,327	6,389	4,969	1,944	205	4,069	3,627
Trans-Texas	1,646,112	1,645,025	14,631	10,598	18,179	4,580	5,943	5,300
TWA	157,518,094	149,153,072	1,204,054	1,069,890	4,784,406	3,815,913	713,536	624,307
United	201,097,764	204,151,836	1,796,031	1,377,356	4,210,869	3,118,165	1,352,867	1,078,627
Western	24,499,220	19,957,974	163,969	151,691	1,122,674	625,822	179,304	108,477
West Coast	1,617,175	1,784,583	14,096	10,398	5,165	503	5,009	3,974
Wien Alaska	1,590,954	1,158,545	35,092	29,082	17,283	10,347	4,464	2,295
TOTALS	$1,337,824,202	1,211,127,315	9,805,367	8,776,998	33,605,391	26,181,272	7,427,555	6,336,191

Airlines' Assets Growing Fast

The U.S. airline industry's growth last year in such categories as total assets, employment and annual payroll was in the 10% to 15% bracket.

But in one department—the feeding and care of passengers—its outlay rose a substantial 26.2%.

Statistics compiled by AMERICAN AVIATION from Civil Aeronautics Board reports for the year ended Sept. 30, 1955, show (for domestic trunk, international, local service, all-cargo and territorial carriers):

- Total assets rose 10.5% over the previous year to $1,337,824,202.
- There were 125,639 persons on the payroll, an 11.3% gain.
- Annual payroll reached $648,862,888, up 14.9%.
- Average wage was $5,164, up 3.3% from $4,999 in 1954.

Feeding passengers and furnishing them with other supplies cost the airlines $41,032,946 in the year ended Sept. 30, up 26.2% over the $32,517,463 spent in the previous year.

The cost of food and refreshments alone totaled $33,605,391, up 28.3%. This was a much larger increase than the gain in passengers carried. Domestically, for example, the passenger increase was about 18%.

Passenger supplies other than food and refreshments—blankets, dishes, linen, sleeper bags, playing cards and numerous other items—rose 17.2% from $6,336,191 to $7,427,555.

- **The big jump** in food expense may be accounted for by increased traf-

for the Years 1954 and 1955

Advertising Space 1955	Advertising Space 1954	Other Advertising 1955	Other Advertising 1954	Employment 1955	Employment 1954	Annual Payroll 1955	Annual Payroll 1954	Average Wage 1955	Average Wage 1954	Company
$ 10,161	$ 2,307	$ 2,087	$ 840	$ 85	$ 65	$ 421,819	$ 333,064	$4,963	$5,124	.... Aerovias Sud
25,158	19,311	56,952	51,742	388	359	2,417,854	2,254,778	6,231	6,280	..... Alaska
4,116	3,962	6,121	7,988	117	101	707,042	631,665	6,043	6,254	.... Alaska Coastal
129,739	86,781	25,936	31,467	626	543	3,274,435	2,554,488	5,231	4,704	..... Allegheny
3,293,594	2,597,798	1,640,321	1,479,020	18,266	15,946	98,598,176	79,997,812	5,397	5,016	..... American
23,577	21,478	23,417	16,190	274	205	1,344,234	1,019,968	4,897	4,963	..... Bonanza
673,942	365,220	347,818	354,857	4,054	3,886	19,840,368	17,664,551	4,894	4,545	..... Braniff
1,139	818	1,460	1,255	6	6	42,500	42,500	7,083	7,083	..... Byers
902,015	881,333	236,090	518,997	4,988	4,585	25,046,791	22,581,874	5,021	4,925	..... Capital
6,228	13,181	11,025	11,452	189	173	630,831	583,223	3,337	3,371	..... Caribbean
24,107	16,205	20,414	14,464	370	290	1,664,755	1,235,636	4,499	4,260	..... Central
270,124	136,907	122,823	103,518	840	789	4,412,809	4,092,484	5,253	5,186	..... Colonial
216,875	166,883	188,740	151,575	1,406	921	7,379,044	4,628,870	5,248	5,026	..... Continental*
5,436	5,048	4,830	2,998	49	40	346,827	283,714	7,078	7,093	..... Cordova
922,222	789,183	370,921	433,210	4,647	4,275	22,525,130	20,600,778	4,847	4,819	..... Delta
3,453,400	2,958,638	649,081	608,331	11,356	10,304	59,425,028	52,791,551	5,232	5,123	..... Eastern
14,407	13,591	4,452	2,338	93	88	558,108	515,796	6,001	5,861	..... Ellis
68,244	10,618	28,448	36,661	1,333	1,465	7,425,347	7,449,146	5,570	5,085	.... Flying Tigers
63,981	46,780	100,189	88,268	658	597	3,236,067	2,930,869	4,918	4,909	..... Frontier
35,926	21,113	47,357	40,537	526	544	2,726,347	2,745,689	5,183	5,047	..... Hawaiian
.....	.....	.....	.....	48	47	274,916	257,885	5,727	5,487	.. Helicopter A. S.
5,710	4,862	9,816	7,879	306	262	1,417,231	1,141,495	4,631	4,349	.... Lake Central
1,851	.....	2,624	.....	84	73	403,127	324,480	4,799	4,445	..... Los Angeles
16,397	not filed	6,090	not filed	not filed		not filed		not filed		..... Mackey
24,212	17,977	56,773	31,046	482	399	2,476,986	1,822,041	5,138	4,566	..... Mohawk
1,297,993	1,122,036	457,393	230,064	3,040	2,911	15,051,088	13,908,477	4,951	4,777	..... National
2,420	1,756	11,349	7,421	115	105	620,581	548,139	5,396	5,220	New York Airways
75,317	43,372	76,265	47,931	825	654	3,923,815	3,020,844	4,756	4,626	.... North Central
137,927	87,280	145,828	115,946	1,062	1,026	5,349,288	5,002,209	5,037	4,873	..... Northeast
8,809	7,407	11,572	6,657	108	118	758,969	741,468	7,027	6,283	. Northern Consol.
1,376,246	1,245,556	568,895	464,490	5,451	4,936	29,812,933	25,435,668	5,469	5,153	..... Northwest
25,027	28,776	19,459	10,643	509	372	2,457,742	1,717,096	4,829	4,616	..... Ozark
63,989	52,373	32,535	25,899	566	455	3,352,673	2,588,407	5,923	5,688	.... Pac. Northern
674,609	598,735	202,005	184,689	1,403	1,448	4,284,658	4,003,602	3,054	2,765	..... Panagra
										Pan American
72,527	55,303	112,734	105,630	397	376	2,662,206	2,524,660	6,706	6,715	..... Alaska
1,366,032	1,624,834	1,636,651	1,196,581	5,785	4,982	28,975,296	25,232,448	5,009	5,065	..... Atlantic
1,073,975	1,022,674	1,183,580	948,179	7,060	7,050	32,660,424	32,206,008	4,626	4,568	. Latin American
676,523	497,227	676,050	638,696	3,604	3,423	19,223,484	17,854,390	5,331	5,216	..... Pacific
.....	.....	.....	.....	2,100	1,918	9,636,924	8,505,552	4,589	4,435	.. Non-divisional
132,552	88,156	105,243	103,982	745	670	3,344,492	3,011,022	4,489	4,494	..... Piedmont
36,932	84,931	4,556	18,417	407	409	2,061,499	1,944,765	5,065	4,754	..... Pioneer*
2,455	2,353	3,163	4,811	46	45	344,347	301,991	7,486	6,711	..... Reeve
39,581	108,524	27,047	40,384	**	226	**	1,022,099	**	4,523	..... Resort
7,165	1,815	14,155	4,555	268	172	1,249,016	830,018	4,661	4,826	..... Riddle
6,412	3,468	5,081	3,694	1,417	804	6,487,776	4,052,693	4,578	5,041	..... Slick
39,853	28,977	32,090	34,198	434	408	1,986,373	1,762,476	4,577	4,319	..... Southern
20,601	32,480	79,780	51,546	392	296	2,080,094	1,488,818	5,306	5,030	..... Southwest
17,554	7,775	15,543	17,543	218	218	1,031,504	941,118	4,732	4,317	..... Trans Pacific
69,506	39,187	56,694	63,715	537	565	2,444,690	2,328,699	4,553	4,121	..... Trans-Texas
3,353,294	2,578,791	2,726,809	2,518,315	17,082	15,254	89,382,460	78,220,609	5,232	5,128	..... TWA
2,591,309	2,042,798	1,558,985	1,468,485	18,120	15,697	98,210,731	83,964,683	5,420	5,349	..... United
545,687	475,477	183,688	140,425	2,122	1,841	11,005,450	9,480,433	5,187	5,150	..... Western
22,903	20,701	62,874	70,167	405	365	2,158,441	1,889,880	5,329	5,163	..... West Coast
12,489	11,798	8,023	4,148	230	151	1,710,160	1,247,427	7,435	8,261	..... Wien Alaska
$23,942,248	29,294,554	13,981,832	12,521,824	125,639	112,858	$648,862,888	564,260,056	5,164	4,999	..... TOTALS

* Continental and Pioneer merged April 1, 1955.
** Not required to be filed in 1955.

—Expenses Going Up, Too

fic, somewhat higher prices, more elaborate service by some carriers, and possibly by the serving of free alcoholic beverages on some flights. Most carriers are believed to include liquor expense under "refreshments" in the food account.

Among the Big Four, Eastern Air Lines, which has concentrated in the past year on improving its food service, spent 51.6% more for this item than it did in 1954. American was up 24.2%, TWA 25.4%, United 35%. Among smaller trunks, Western Air Lines, whose emphasis on "champagne" service has paid off handsomely in traffic increases, upped food expense 79.4%.

As a group, the local service lines were up a surprising 73.4% in the food account. Allegheny, for example, spent only $879 in 1954, while the 1955 figure was $6,250. North Central jumped from $2,651 to $23,073. West Coast went from $503 to $5,165.

For the purchase of newspaper and magazine advertising space, the U.S. airlines spent $23,942,248, an increase of 17.9%. In the Big Four, Eastern, the biggest space buyer at $3,453,400, was below the average increase, showing a 16.7% jump. American was up 26.8%, TWA 30%, United 26.8%.

Advertising expense other than purchase of space—stickers, displays, calendars, novelties, maps, etc.—totaled $13,981,832, up 11.6%.

Shop and servicing supplies showed almost the same increase—11.7%—from $8,776,996 in 1954 to $9,805,367.

◆ ◆ ◆

1955 Gas & Oil Consumption

The U.S. scheduled airlines, in their domestic, international and territorial operations, spent some $218,424,272 for aviation gasoline and oil for the 12-month period ending September 30, 1955, a 9.6% jump over the $199,624,104 expended in calendar 1954.

In all, these carriers purchased 1.14 billion gallons of avgas (up 12.2%) and 13.7 million gallons of oil (up 14.4%) for the year.

And for the first time the record brought first specific information on what to look forward to in turboprop fuel and oil consumption. Capital Airlines, operating Vickers Viscounts, burned 500,700 gals. of turboprop fuel and 75 gals. oil (a 6,676 to 1 ratio) in operations to September 30. By the year-end, Capital consumed 1,826,928 gals. fuel and 658 gals. oil, bringing the fuel/oil ratio to 2,776 to 1.

For overall airline piston transport operations, last year's procurement works out to a ratio of 83-to-1 on fuel and oil consumption. The sharp increase to a 2,776 ratio on Viscounts emphasizes the effect of higher fuel and lower oil consumption in the coming jet and turboprop era.

Here's how the various groups of carriers reported fuel and oil consumption and costs to the Civil Aeronautics Board:

DOMESTIC

Carrier	Fuel (Gallons)	Oil (Gallons)	Total Cost (Fuel & Oil)
American	180,028,439	2,489,229	$ 32,984,963
Braniff	26,308,458	320,771	4,659,882
Capital	42,481,934	490,376	7,449,583
Colonial	4,936,897	46,652	910,865
Continental	10,481,944	134,452	1,895,364
Delta	40,595,601	494,209	7,354,085
Eastern	143,738,578	1,737,762	25,839,456
National	33,217,489	334,449	5,837,050
Northeast	5,805,824	71,449	1,122,024
Northwest	39,084,939	441,072	7,090,424
TWA	126,418,891	1,793,584	22,053,718
United	159,145,672	1,818,535	28,783,149
Western	22,158,339	241,490	4,094,148
TOTALS	834,403,007	10,414,030	$150,074,711

INTERNATIONAL

Carrier	Fuel (Gallons)	Oil (Gallons)	Total Cost (Fuel & Oil)
American	3,639,792	50,348	$ 660,281
Braniff	5,806,683	53,559	1,381,464
Colonial	1,081,232	11,438	209,226
Delta	3,560,722	53,067	825,372
Eastern	9,652,674	115,674	1,778,586
Mackey	477,601	4,710	102,347
National	2,923,523	29,290	625,968
Northwest	13,179,781	139,825	3,012,691
Pan American			
Atlantic	54,736,696	505,580	13,521,108
Latin-American	47,511,278	485,161	9,706,901
Pacific	37,245,927	404,599	8,652,704
Alaskan	4,303,622	41,591	1,070,487
Panagra	8,500,112	96,486	2,525,580
TWA	33,356,173	408,649	7,799,871
United	7,745,182	92,063	1,378,517
TOTALS	233,670,998	2,492,040	$ 53,251,103

LOCAL SERVICE

Carrier	Fuel (Gallons)	Oil (Gallons)	Total Cost (Fuel & Oil)
Allegheny	3,712,275	49,732	$676,116
Bonanza	1,509,748	17,460	285,665
Central	1,800,639	27,564	353,155
Frontier	3,562,183	48,958	698,663
Lake Central	1,572,563	17,797	297,213
Mohawk	2,678,061	23,250	521,027
North Central	4,310,418	29,071	753,642
Ozark	2,954,272	30,660	513,242
Piedmont	4,628,715	66,791	835,585
Southern	2,253,784	26,471	462,555
Southwest	2,805,854	34,592	521,337
Trans Texas	3,363,702	44,375	589,153
West Coast	2,506,223	23,104	439,293
TOTALS	37,658,437	439,825	$6,946,646

TERRITORIAL

Carrier	Fuel (Gallons)	Oil (Gallons)	Total Cost (Fuel & Oil)
Alaska	2,513,696	32,599	$665,671
Alaska Coastal	454,303	5,784	119,348
Byers	18,155	266	8,871
Caribbean	549,832	5,450	116,240
Cordova	401,926	4,693	104,977
Ellis	288,708	3,621	76,147
Hawaiian	2,778,226	46,906	517,986
N. Consolidated	527,558	5,113	205,422
Pac. Northern	4,352,177	52,664	1,024,931
Reeve	315,034	11,875	86,229
Wien Alaska	N.A.	N.A.	552,229
TOTALS	13,285,018	173,768	$3,478,051

ALL CARGO

Carrier	Fuel (Gallons)	Oil (Gallons)	Total Cost (Fuel & Oil)
Aerovias	1,611,937	18,770	$518,490
Flying Tiger	8,779,061	106,517	1,812,820
Riddle	2,559,492	36,121	582,363
Slick	7,405,508	73,078	1,624,511
TOTALS	20,355,998	236,486	$4,538,184

HELICOPTERS

Carrier	Fuel (Gallons)	Oil (Gallons)	Total Cost (Fuel & Oil)
Helicopter Air S.	96,158	1,291	$18,840
Los Angeles	274,101	5,282	49,854
New York	309,702	8,804	66,883
TOTALS	679,961	15,377	$135,577

All date based on period October 1, 1954 through September 30, 1955.

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P&W R1830

Airline	Model	Time (Hrs.)
AAA	-92	1200
BAL	-90D	1200
BNF	-90D	1250
CAL	-92	1300
CBA	-67	1050
CEN	-90D	1200
FAL	-92	1000
HAL	-92	1400
LCA	-90D	1200
NEA	-92	1300
NWA	-92	1200
OZA	-90D	1200
PAA-ATL	-92	1200
PAI	-92	1100
SOU	-90D	1200
TPA	-92	1200

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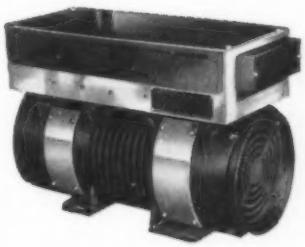
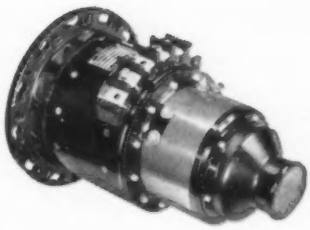
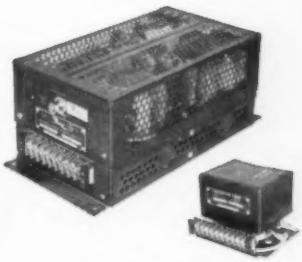


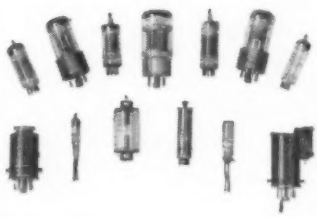
High-Altitude and Missile
INVERTERS



High-Temperature
AC GENERATORS



AC Voltage Regulators
(Magnetic Amplifier Type)
and
SYSTEM COMPONENTS



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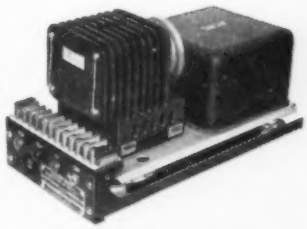

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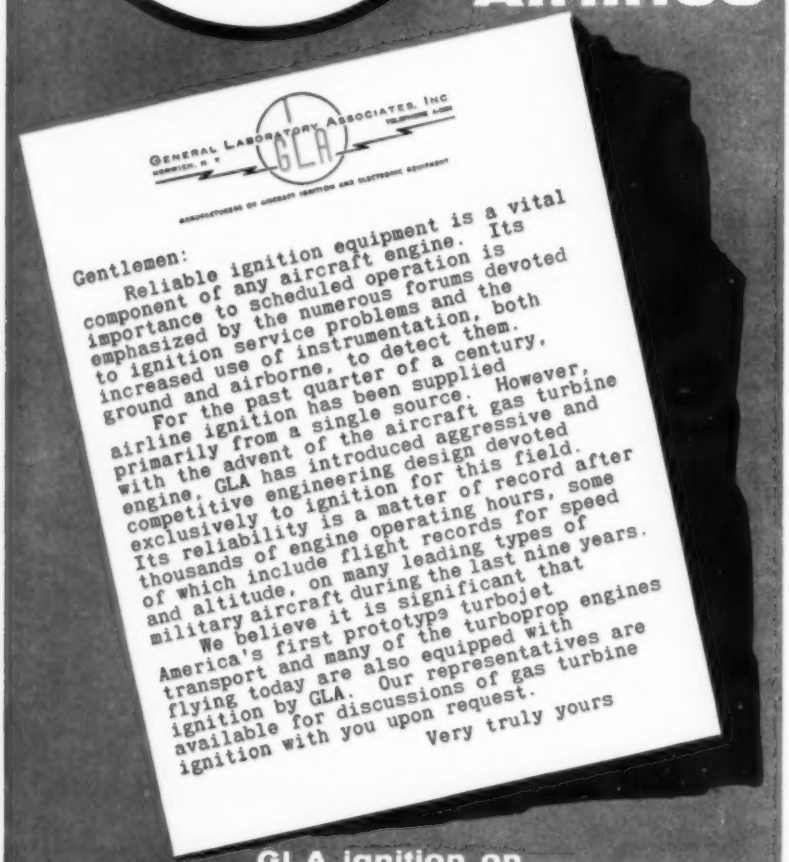
GLA

Ignition

Open letter to the **Airlines**



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EAL		-D5	1700
NWA		-13	1500
PAA-ATL		-D3, D5	1800
-PAC		D3	1800
TWA		-9	1600
UAL		-11C	1500
WAL		-11M3	1500
	P&W R2800		
AAA		-85	1000
AA		-34, -83	1500
		-CB16*	1800
BNF		-CB16	1300
		-83AM5	1300
		-85	1000
CAL		-CB16	1400
DAL		-CB16**	1400
		-CB16	1500
EAL		-CB3	1700
HAL		-CB3	1400
MOH		-CA3	1000
NAL		-CB16**	1300
		-CB16	1500
NEA		-CB3	1300
NWA		-CB16	1500
PAA-ATL		-CB16/17	1500
-PAC		-CB16	1500
TWA		-CB16	1600
UAL		-CB16**	1100
		-CB16***	1400
		-CB16	1800
		-CB16	1000
		-CB16	1700
WAL		-CB16**	1500

**Period varies with type of equipment.*
***Twin engine installations.*
****UAL has 1400 on DC-6Bs, 1800 on DC-6s.*

	P&W R4360		
NWA		-CB2	1100
PAA-ATL		-B6	1300
-PAC		-B6	1200
	WRIGHT R1820		
CAP		G-200	1500
DAL		G-202A	1500
MOH		G-202A	1400
NAL		G-202A	1450
	WRIGHT R3350		
BNF		-BA3	1000
CAP		-BA3	1300
EAL		-CB1	1400
		-BD1	1925
TWA		-BA3	1300
		-BD1	1900
		-CB1	1400
	WRIGHT TURBO COMPOUND		
AA		-DA2	1000
DAL		DA2	1100
EAL		DA1, DA4	1100
NAL		DA2	1100
NWA		DA3	1100
PAA-ATL		DA4	1000
TWA		-DA3	1000
UAL		-DA2, DA4	900
	TURBOPROPS		
CAP		Dart RDa5	1000

HELICOPTER ENGINES

	AIRCOOLED MOTORS		
HAS		6V4-200	720
	PRATT & WHITNEY		
LAA		R985-B4	1100
		R1340-40	800
NYA		R1340-40	700

Aircraft Seating

DOUGLAS DC-3

Airline	No. of Seats*
AAA	24
BAL	28
BNF	21-24
CAI	26
CAL	21-24
CAP	24
CBA	28
CEN-	22
DAL	25
FAL	24
HAL	24-28
LCA	21-26
MOH	28
NEA	24
NOR	21-25
OZA	27
PAI	24
SOU	21-26
SWA	28
TPA	28
TTA	25
WCA	24
WAL	22

** Only airlines using more than standard 21 seats shown.*

DOUGLAS DC-4

CAI	60
CAP	55-60
NWA	42-62C
PAA-ATL	56
-ALA	20
TWA	70
UAL	64
WAL	66

DOUGLAS DC-6/6B

AA	54-80
BNF	50-52
CAL	54-58
DAL	60-70
NAL	60-86
NWA	44-76
PAA-ATL	49-81
-PAC	65
UAL	58-64
WAL	60

DOUGLAS DC-7

AA	60-85
DAL	64-69
NAL	69
PAA-ATL	52-74
UAL	54-58

CONVAIR 240

A11	40

CONVAIR 340

A11	44

LOCKHEED L-49/649/749

BNF	54
CAP	56
EAL	60
TWA	55-81

LOCKHEED L-1049

NWA	50-65
TWA	47-71

BOEING 377

NWA	83
PAA-ATL	43-56

VICKERS VISCOUNT

CAP	44

MARTIN 2-0-2/4-0-4

AAA	40
SWA	40
TWA	36-40

Operating Costs of New Transports Show Increase, Older Types Decrease

Aircraft direct-operating costs, those "out of pocket" expenses which represent a healthy share of overall airline expenditures, followed a fairly consistent pattern in 1955. Costs dropped slightly for older aircraft, but increased for the newer models.

Of six major transport types covered in an AMERICAN AVIATION survey, four showed reduced costs, while two reflected increases.

Here's how individual models fared, based on analysis of costs reported by a number of airlines (all figures are averages):

• **Douglas DC-3**—Eleven local service airlines, representing the bulk of DC-3 operation, continued to show cost reductions. Plane-mile costs were 49.98¢, a slight drop from 50.82¢ in 1954 and 51.93¢ in 1953.

• **Douglas DC-4**—Costs dropped approximately 4.6% for nine carriers from 83.45¢ in 1954 to 79.78¢ last year. In 1953 six of these airlines averaged direct costs of 106.29¢. Biggest area of cost-cutting was in Pan American's Pacific and Atlantic Division operations which showed a drop from 133.68 to 104.0¢ and 121.0 to 99.0¢ respectively for the three-year span.

• **Douglas DC-6**—Five carriers averaged 97.87¢ per plane mile, a 3% increase over 94.99¢ last year. Costs in 1955 returned to 1953 levels of 97.38¢. In DC-6A cargo operations, two airlines averaged 119.5¢ almost a 2¢-per-plane-mile increase over last year. Seven DC-6B operators recorded a 119.5¢-DOC, a slight drop from 120.26¢ in 1954.

• **Douglas DC-7**—Newer DC-7s operated by four airlines showed a 2.7% cost increase, averaging 119.55¢ in 1954 and 123.9¢ last year.

• **Convair 340**—Three carriers operating Convair 240s dropped plane-mile costs 3.9% from an 80.33¢ in 1954 to 77.33¢ in '55. For five Convair 340 operators, costs dipped slightly from 82.98¢ in '54 to 82.47¢ last year, but remained about 3% above the 1953 level.

• **Boeing 377**—In Boeing Stratocruiser operations, the cost trend continued its steady improvement of the past several years. Three carriers averaged 165.28¢ per plane mile, an 11.6% drop from 186.94¢ in 1954.

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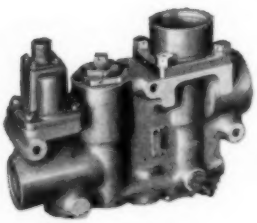

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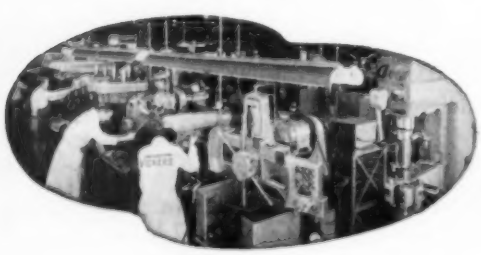

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Aircraft Direct Operating Cost

(Cents per plane mile)

Scheduled U.S. Airlines

Editor's Note: Direct operating costs shown here for 1953 through 1955 make interesting general comparisons but are not suitable for comparing costs of any two airlines operating the same type aircraft. Such an appraisal demands more detailed information on the carriers' depreciation of equipment, route structure (trunk or local service), type of operation and scope of equipment modifications. All data secured in an AMERICAN AVIATION *survey.*

DOUGLAS DC-3

Airline	1955	1954	1953
AAA	50.85	53.27	55.07
BAL	46.43	46.82	50.57
BNF	44.07	45.87	45.93
CAA	65.06	....	....
CAI	58.91	63.00	55.30
CAL	47.14	49.32*	51.60*
CAP	45.40	45.70	43.00
CEN	50.03	52.43	54.76
DAL	43.81	45.71	40.51
FAL	47.78	47.11	47.80
HAL	56.56	51.61	48.78
LCA	51.87	55.41	54.08
MOH	54.00	54.30	56.00
NEA	55.10	50.02	49.15
NOR	49.74	54.36	....
NWA	55.05	61.67	62.02
OZA	52.53	53.94	59.75
PAI	48.41	51.03	49.05
SOU	45.54	46.95	....
SWA	49.71	50.01	49.54
TPA	45.32	44.80	43.66
TTA	47.98	45.46	46.75
UAL	74.67	50.86	47.99
WAL	41.63	44.47	....
WCA	50.22	49.25	47.86

* *Pioneer Air Lines' figures shown.*

DOUGLAS DC-4

AA	79.00C	79.40C	87.80C
CAI	81.44	82.30	76.30
	83.26F	86.70F	77.00F
CAP	68.70	66.90	65.50
EAL	70.72	....	....
NWA	72.55	77.01	76.56
	89.44F	94.33F	90.54F
PAA-ALA	75.00	86.93	76.95
-ATL	99.00	106.00	121.00
-LAD	76.00	....	....
-PAC	104.00	121.12	133.68
TWA	74.80	....	79.51
	122.73FC	....	116.55FC
UAL	70.05	65.59	....
	63.81C	62.78C	....
WAL	68.32	65.81	....

DOUGLAS DC-6

AA	84.00	93.40	91.10
	89.00F	90.90F	95.00F
BNF	92.13	92.62	98.83
	98.61F	105.51F	114.82F
CAL	102.72	....	....
DAL	119.10	99.24	104.44
NAL	109.73	101.76	105.24
	105.09F	109.68F	....
PAA-LAD	127.00	....	....
UAL	84.41	87.95	87.32
	87.23F	87.37F	87.50F

DOUGLAS DC-6A

AA	103.00	104.10	....
PAA-ATL	136.00	131.00	....
-LAD	94.00	....	....

DOUGLAS DC-6B

CAL	139.65	....	118.74
NAL	110.79	105.39	....
	111.62F	104.96F	....
NWA	116.19	107.60	....
	127.13F	122.23F	....
PAA-ALA	126.00	126.61	....
-ATL	136.00	144.00	....
-LAD	112.00	....	....
-PAC	154.00	159.84	....
UAL	97.44	99.14	....
WAL	96.25	99.26	....

DOUGLAS DC-7

AA	125.00	127.70	120.20
DAL	123.39	125.80	....
	137.11F	....	....
EAL	166.71	....	....
NAL	135.73	125.59	109.12
	111.62F	....	....
PAA-ATL	137.00*	....	....
UAL	111.49	99.14	....
	119.89F	....	....

* *DC-7B.*

CONVAIR 240

AA	71.00	80.10	76.30
NEA	92.50	91.28	98.68
PAA-LAD	75.00	....	....
WAL	68.48	69.62	....

CONVAIR 340

BNF	74.99	76.36	69.78
CAL	71.50	....	....
DAL	77.00	73.34	69.27
	80.31F	77.62F	70.41F
HAL	98.14	105.21	93.42
MOH	93.56	....	....
NAL	78.88	78.95	73.61
	79.56F	76.99F	....
UAL	83.33	81.07	93.33

LOCKHEED L-49

BNF	124.10	....	....
PAA-LAD	115.00	....	....
TWA	93.62	....	104.02

LOCKHEED 649/749

CAP	120.20	111.30	97.80
EAL	94.99	86.25	106.59
TWA	101.95	....	106.44
	133.42F	....	....

LOCKHEED 1049

EAL	135.44	132.37	146.89
TWA	131.42	....	132.28

LOCKHEED 1049C

EAL	145.52	142.84	....

LOCKHEED 1049G

NWA	175.78	....	....
TWA	136.90	....	....
	229.10	....	....

MARTIN 2-0-2

AAA	101.13	....	....
SWA	83.24	89.80	85.82
TWA	88.29	....	....

MARTIN 4-0-4

EAL	86.65	89.94	91.62
TWA	85.73	....	87.34

CURTISS C-46

BNF	72.55C	....	....

(Continued on next page)

BOEING 377

Airline	1955	1954	1953
NWA	158.84	163.69	168.80
	194.39F	194.87F	205.93F
PAA-ATL	177.00	223.00	....
-PAC	160.00	174.13	183.44

HELICOPTER OPERATIONS

BELL 47G

HAS	67.30	....	....

SIKORSKY S-55

NYA	185.00	....	....

C — Cargo. F — International.
FC — International Cargo.

Airline Maintenance Costs

(Per Hour of Flight)

DOUGLAS DC-3

Airline	1955	1954	1953
AAA	$ 17.66	$ 16.99	$ 17.68
BAL	15.77	18.34	17.44
BNF	16.90	16.58	18.72
CAP	14.65	14.03	14.01
CBA	31.00	34.00	.....
CEN	17.96	18.22	17.91
CAI	22.79	24.75	22.02
CAL	16.73	.....	.....
DAL	15.09	15.71	12.73
HAL	24.78	20.40	19.86
LCA	19.45	21.65	22.87
MOH	18.44	17.20	20.64
NEA	20.40	17.89	18.52
NOR	19.08	.....	.....
NWA	18.49	16.16	19.68
OZA	20.09	18.76	19.95
PAI	17.58	18.53	18.84
SOU	15.92	18.70	21.99
SWA	17.48	14.18	14.09
TPA	16.12	16.85	14.60
TTA	17.47	14.27	18.09
UAL	34.55	18.99	16.16
WAL	14.16	.....	.....
WCA	13.55	13.35	.....

DOUGLAS DC-4

AA	$ 66.91	$ 62.94	$ 61.52
CAP	37.23	36.89	34.95
CAI	47.22	48.90	44.89
NWA	40.53	41.16	38.63
PAA-ALA	39.56	.....	.....
-ATL	52.17	40.10	38.63
-PAC	51.21	52.61	37.98
TWA	46.16	43.92	47.61
UAL	39.35	28.18	30.69
WAL	38.58	.....	.....

DOUGLAS DC-6

AA	$ 50.60	$ 57.57	$ 59.41
BNF	64.31	55.66	68.65
CAL	32.65	.....	.....
DAL	83.23	55.78	72.53
UAL	54.02	38.15	40.20

DOUGLAS DC-6B

CAL	$ 75.70	.....	.....
NAL	57.85	$61.12	$57.40
NWA	46.37	34.49	.....
PAA-ALA	47.02	38.22	.....
-ATL	56.29	57.15	65.65
-PAC	52.04	.....	.....
UAL	52.26	38.55	40.35
WAL	43.18	.....	.....

DOUGLAS DC-7

AA	$105.60	$105.89	$112.33
DAL	85.97	99.66	.....
EAL	83.83	.....	.....
NAL	113.30	83.39	.....
PAA-ATL	71.42	.....	.....
UAL	77.66	41.30	.....

CONVAIR 240

AA	$41.02	$48.31	$49.23
MOH	61.27	.....	.....
NEA	52.90	63.08	42.03
WAL	39.06	.....	.....

CONVAIR 340

BNF	$39.06	$37.02	$28.85
CAL	36.29	.....	.....
DAL	40.08	37.17	36.86
HAL	35.45	38.89	29.72
NAL	37.08	33.01	.....
UAL	38.86	28.04	33.22

LOCKHEED L-049

BNF	$52.78	.....	.....
TWA	68.72	$50.93	$52.65

LOCKHEED L-649/749

CAP	$ 76.82	$ 57.59	$ 73.25
EAL	78.61	47.08	.....
TWA	56.93	48.43	57.47

LOCKHEED 1049

EAL	$72.01	$70.94	.....
TWA	79.94	58.33	$70.96

LOCKHEED 1049C

EAL	$78.14	$75.32	.....

LOCKHEED 1049G

NWA	$71.10	.....	.....
TWA	61.60	.....	.....
	86.76F	.....	.....

BOEING 377

NWA	$96.13	$101.56	$121.78
PAA-ATL	107.48	125.85	133.99
-PAC	92.81	88.66	109.05

MARTIN 2-0-2/2-0-2A

AAA	$52.40	.....	.....
SWA	42.51	$38.18	$40.01
TWA	38.03	.....	.....

MARTIN 4-0-4

EAL	$34.51	$33.67	.....
TWA	38.46	30.71	$37.86

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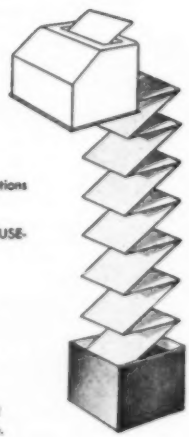

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Hinshaw Urges Rise In Baggage Allowance

The domestic baggage allowance of 44 lbs. should be raised by the U.S. airlines to the 66-lb. limit that applies elsewhere in the world, according to Rep. Carl Hinshaw (R.-Calif). And he has a resolution ready for introduction to accomplish the equalization.

Hinshaw, a member of the Interstate and Foreign Commerce Committee, said that the 40-lb. limit, first-class and coach, "is as antique as the Boeing 247-D. It should be brought up to date. The same baggage allowance should persist all over the world for the same class of ticket, and this discrimination against the domestic traveler should be abolished.

"Abroad they recognize that passengers paying first-class fares should receive first-class treatment as to baggage allowance. Abroad you can carry 66 lbs. anywhere on a first-class ticket. A tourist passenger can carry 44 lbs. A U.S. coach passenger to Hawaii or Alaska is entitled to carry 44 lbs., too. It is only the continental U.S. passenger who is limited to 40 lbs."

• **A foreigner** traveling to the U.S. is entitled to carry 66 lbs. without extra charge on domestic routes, he pointed out, adding that "a Cuban can travel all over the U.S., if he is ticketed for it, carrying 66 lbs., and the only difference . . . is that he flew over the 90 miles of the Gulf Stream. I suppose that entitled him to an advantage."

On a Washington-Los Angeles trip made entirely in the U.S., the round-trip fare is $283.86 and excess baggage is 75c per lb., Hinshaw said. "If 66 lbs. are carried, the round-trip plus excess at $39 is $322.80. But if the trip is made via Mexico City (and you can make it either or both ways) for $59 additional over the round-trip fare, the total round-trip is $342.80, and 66 lbs. can be carried with no extra charge. So the side trip to Mexico City is really a bargain to the 66-lb. baggage person—it only costs $20 net extra.

"On mileage, it is really a bonanza." Washington-Mexico City-Los Angeles round-trip is 7526 miles, he said, while Washington-Los Angeles is 4620. "So it will cost $20 for 2906 extra miles of flight, or $.007 per mile if the Mexico City privilege is used both ways. That is the cheapest passenger transportation I know of anywhere.

"The U.S. air carriers certainly discriminate against Americans who travel in the U.S. and in favor of foreigners and those Americans who travel abroad . . . But let someone say . . . (they) ought to treat Americans at least as well as they treat foreigners and a cry goes to high heaven that someone is robbing them of revenue."

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Heavy Transport Aircraft Specifications

U.S. Military Aircraft

Mfr. & Model	Gross Weight (lbs.)	Oper. Empty Weight	Payload (lbs.)	Range—Max. (miles)	Fuel Cap. (Gals.)	Engines	Takeoff HP/Thrust	Rate of Climb (sea level, fpm)	ROC (One Eng. Out, S.L. fpm)	Cruising Speed mph.	Seating Provisions	Wing Loading (lbs. sq. ft.)	Power Loading (lbs./bhp)	Stall Speed (mph)	Wing Span	Length	Height	Capacities: Main Cabin (cu. ft.)	Auxiliary Comp'ts. Cabin (cu. ft.)	Other Cargo Holds (cu. ft.)
Boeing Airplane Co.																				
C-97 & KC-97	175,000	79,700 / 80,400 or 86,400	53,000	7,790	7,790	P&W (4) R4360-35 / P&W (4) R4360	3,500	1,300	650	315	130 troops 79 lits.	84.5	10.7	97	141' 3"	110' 4"	38' 3"	4,851	472	1,345
KC-135	275,000					P&W (4) J57				500-600										
Convair																				
T-29C/D	43,575	29,000		2,000	1,530	P&W (2) R2800-99W	2,500	1,370		247		53.8	9.1	92	91' 9"	74' 8"	26' 11"			
C-131A	43,575	27,500		1,600	1,530	P&W (2) R2800-99W	2,500	1,410		247	35 troops 27 lits.	53.8	9.1	92	91' 9"	74' 8"	27' 3"			
C-131B	47,000	29,846		1,200	1,730	P&W (2) R2800-103W	2,500			284	44	51.06	9.8	86	105' 4"	79' 2"	28' 2"	1816.7	436.6	77.8
YC-131C	47,000				1,730	Allison (2) YT56-A3	3,250			366	44				105' 4"	79' 2"	28' 2"			
C-131D	47,000	29,600		1,260	1,730	P&W (2) CB-16	2,400	1,220		284	44	51.1	9.8	86	105' 4"	79' 2"	28' 2"	1,816	436.6	88.6
R3Y-1	165,000		48,000	2,000		Allison (4) T40-A10	5,500			350	80 72 lits.				145' 9"	139' 8"	51' 5"	4,105		
R3Y-2	165,000		48,000	2,000		Allison (4) T40-A10	5,500			350	103 92 lits.				145' 9"	139' 8"	51' 5"	5,396		
R4Y-1	47,000	30,684	16,316	2,089nm	1,730	P&W (2) R2800-52W	2,500	1,330			44 21 lits.	48.7	9.4	86	105' 4"	79' 2"	28' 1"	2,300		none
Douglas Aircraft Co.																				
C-47	26,000	18,100	7,900	450	804	P&W (2) R1830	1,200	1,170	220	207		26.3	10.8	70	95'	63' 9"	16' 11"	1,245	38.7	
C-54	62,000	38,900	13,100	4,200	3,544	P&W (4) R2000	1,450	1,080	570	240		42.3	10.7	82	117' 6"	93' 5"	27' 7"	3,238		261
C-118A	107,000	52,018	20,500	3,200 / 4,970	5,512	P&W (4) CB-17	2,500	1,000	520	315	60-76	73.7	10.7	97	117' 6"	105' 7"	28' 8"			567
C-124C	185,000	101,165	56,511	1,000 / 5,120	11,058	P&W (4) R4360-63A	3,800	1,260	540	264	200 tr. 127 lits.	73.8	12.2	106	174' 1"	130' 5"	48' 3"	10,000		
C-133A	255,000					P&W (4) T34-P3	6,000								179' 8"	148' 2"	48'			
Fairchild Aircraft Div.																				
C-119G	64,000	39,920	21,550	1,152	2,634	Wright (2) R3350-89W	3,500	1,120	330	202	42	51.5	10.6	88	109' 3"	86' 3"	26' 3"	3,150		
C-123B	56,500	30,812	15,523	1,280	1,462	P&W (2) R2800-99W	2,500	875	169	165	60	46.19	11.3	75	110'	76' 3"	34' 1"	3,570		
Lockheed Aircraft Corp.																				
C-121C	133,000	73,113	28,000	3,800	7,750	Wright (4) R3350	3,250	1,640			75 47 lits.	80		101	123' 5"	116' 2"	24' 9"	4,875		693
C-130A	124,000		40,000			All. T56	3,750				92				132' 7"	95' 2"	38' 4"			
R7V-2	150,000	72,219	36,360	4,000	8,770	P&W T34	5,550	3,360		440	87-106	93		104	117'	116' 2"	24' 9"	4,770		693
The Glenn L. Martin Co.																				
JRM-1	145,000	76,805	65,000†	5,800	13,220	Wright R3350 (4)	2,250	570	260	185	133 troops	39.3	16.1		200'	120' 3"	44' 7"	4,000		
JRM-2	165,000	80,311	68,200	6,750	13,220	P&W-R4360 (4)	3,000	611	422	215	133 troops	44.7	13.75		200'	120' 3"	44' 7"	4,000		

U.S. Civil Aircraft

Boeing Airplane Co.																				
B-377	145,800	83,500	30,000		7,790	P&W (4) R4360	3,500	1,100	650	315	60-80	80.5	10.2	93	141' 3"	110' 4"	38' 4"	4,041	1,282	845
707-120	246,000	104,700	32,500 to 40,000	4,650	13,478 to 17,398	P&W (4) JT3C-4		1,650	1,050	590	109-152	101		115	130' 10"	134' 6" to 144' 6"				1,290 to 1,670
707-220	248,000	111,300	30,900	4,000	15,448	P&W (4) JT4A-3		3,200	2,000	605	109-152	102		115	130' 10"	134' 6" to 144' 6"				1,290
707-320	295,000	118,900	37,500 to 38,000	6,100	21,200 to 23,550	P&W (4) JT4A-3		2,850	1,500	600	122-159	101		115	130' 10"	146' 8" to 153' 4"				1,500 to 1,700
Convair																				
240	41,200	27,208	9,262	910	1,000	P&W (2) CB-18	2,400			272	40	50.4	8.6		91' 9"	74' 8"	26' 11"	1,651	344	88
340	47,000	29,486	12,660	2,015	1,750	P&W (2) CB-16	2,400			284	44	51.08	9.8	86	105' 4"	79' 2"	28' 2"	1,816	436	77
440	49,100	31,305	12,880	2,180	1,730	P&W (2) CB-17	2,500	798		289	44-52	53.3	10.0	87	105' 4"	79' 2"	28' 2"	1,816	436	77
600	170,000	72,600	19,700 to 22,835			G.E. (4) J79				580	80-99	85.0			118' 4"	118' 5"	35' 2"			850
Douglas Aircraft Co.																				
DC-6	95,200	51,460	19,750	4,260*	4,248	P&W (4) CA-15	2,400	1,100	490	304	48-76	65.6	9.9	91	117' 6"	100' 7"	28' 8"			373
DC-6A	107,000	52,018	29,500	3,200 to 4,970	5,512	P&W (4) CB-17	2,500	1,000	520	315	60-76	73.7	10.7	97	117' 6"	105' 7"	28' 8"			567
DC-6B Domestic	100,000	54,193	23,490	3,200 to 4,360	4,934	P&W (4) CB-16	2,400	1,040	530	315	50-102	68.4	10.4	95	117' 6"	105' 7"	28' 8"			509
DC-6B Overseas	107,000	58,252	22,950	3,190 to 4,850	5,512	P&W (4) CB-17	2,500	1,000	520	315	54-97	73.1	10.7	97	117' 6"	105' 7"	28' 8"			509
DC-7	122,200	67,292	20,000	4,050 to 4,430	5,512	Wright (4) R3350 TC	3,250	1,320	570	358	64-99	83.5	12.5	99	117' 6"	108' 11"	28' 7"			631
DC-7B Domestic	126,000	68,530	23,000	3,180 to 4,430	5,512	Wright (4) R3350 TC	3,250	1,230	550	349	64-99	110.0	12.5	99	117' 6"	108' 11"	28' 7"			631
DC-7B Overseas	126,000	69,838	23,000	3,490 to 5,120	6,400	Wright (4) R3350 TC	3,250	1,230	530	349	64-99	110.0	12.5	99	117' 6"	108' 11"	28' 7"			631
DC-7C	140,000	72,643	20,083	4,605 to 6,010	7,860	Wright (4) R3350 TC	3,400	845	507	359	58-99	85.0	10.2	99	127' 6"	112' 3"	31' 10"			651
DC-8 Domestic	265,000	119,726	34,280	3,550 to 4,030	17,600	P&W (4) JT3C or JT4A				561-586	122-144	96.0			139' 9"	148' 10"	42' 4"			1,445
DC-8 Overseas	287,500	128,862	36,930	4,470 to 4,810	21,615	P&W (4) JT4A				582-586	132-144	104.0			139' 9"	148' 10"	42' 4"			
Frye Corp.																				
F-1A Cargo	37,000	22,708	12,220	1,940	1,200	P&W (4) R1340	600	860	475	177		24.6	15.4	63	109' 6"	75' 11"	30'	2,600	305	
F-1C	37,000	25,218	9,581	1,940	1,200	P&W (4) R1340	600	860	475	177	51	24.6	15.4	63	109' 6"	75' 11"	30'	2,744	240	
Lockheed Aircraft Corp.																				
049D	96,000	66,000	17,710	4,200	4,690	Wr. (4) C18BA3	2,200			305	43-81	58.2	10.9	83	123'	95' 2"	22' 5"	3,750		434
649A	98,000	66,700	17,710	4,370	4,690	Wr. (4) C-18BD1	2,500	1,370	740	328	46-80	59.4	9.8	91	123'	95' 2"	22' 5"	3,750		434
749 & 749A	107,000	67,300	17,710	5,100	5,820	Wr. (4) C18BD1	2,500	1,180	590	328	46-57	64.9	10.7	91	123'	95' 2"	22' 5"	3,750		434
1049	120,000	75,912	21,400	5,330	6,550	Wr. (4) C18CA1	2,700	1,163	576	327	88	72.8	11.1	94	123'	113' 7"	24' 9"	4,800		680
1049C	133,000	70,062	24,255	4,820	6,550	Wr. (4) R-3350 DA-1	3,250	1,125	540	About 335	47-99	80.6	10.23	101	123'	113' 7"	24' 9"	4,800		728
1049D	133,000	70,950	36,200	4,940	5,820	Wr. (4) R3350 DA-1	3,250	1,125	540	About 335	(Cargo)	80.6	10.23	101	123'	113' 7"	25' 9"	4,875		693
1049E	133,000	70,167		4,940	6,550	Wr. (4) R3350 DA-1	3,250	1,125		335	47-94			101	123'	113' 7"	24' 9"			
1049G	137,500	73,016	(Both wing tip tks)	5,580	7,750	Wr.(4) R3350 DA-3	3,250	1,125		334	47-94	83		101	123' 5" (with tip tks)	116' 2"	24' 9"			
1049H	137,500	20,000	40,000	5,580	7,750	Wr. (4) DA-3	3,250	1,125		334		83		101	123' 5"	116' 2"	24' 9"	4,875		693
1649A	156,000	85,553		7,000	9,600	Wr. (4) EA2	3,400	1,080		350	47-94	84		101	150'	116' 2"	24' 9"			
188 Electra	110,000	53,993		3,000	5,280	Allison (4) 501	3,750 ehp	2,950		410	44-91			102	99'	104' 2"	32' 3"			535

(Continued on page 140)

THE ERA OF THE ELAND

The 'Lion' of the turbo-props

1956-1966 will be the era of the Eland. For at least those ten years the Napier ELAND will lead the turbo-props, just as the old Napier LION led the piston-engines of its day. A confident claim? Yes—but it's justified by facts. Here are the facts:

We made the right basic decision

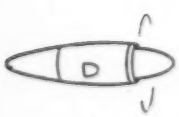
From the first we decided on a single-spool turbo-prop. The advantages over a twin-spool were always obvious: lower weight with greater simplicity, flexibility, safety and economy. Yet it was an all-or-nothing decision, for everything depended on the compressor. We were sure we could make the compressor we needed, and events have proved us right. The compressor of the Eland has the highest stage-loading of any in the world.

We did the right basic research

We decided early on to go right back to fundamentals. So, in 1947, at Liverpool, we built the largest gas turbine research station in Europe. In it we have done 8 years' continuous work on compressor and turbine design techniques. In it we have developed a unique engine control system which guarantees that the Eland turbines will never have to meet higher temperatures than they have already met for thousands of hours on test-bed and in the air. The performance and safety and flexibility of the Eland rest upon sure foundations.

The right engine at the right moment

Medium-haul airlines all over the world are faced with the problem of changing over to turbo-props in the 3,000-4,000 e.h.p. range. Elands are the imaginative, *and the safe,* answer. Because of its simplicity the Eland is inherently safe—*and* economical to run and service. Because of its flexibility it is adaptable to any and every operating condition. These qualities, plus small diameter and excellent power-weight ratio, make the Eland a good engine both for new aircraft and for conversion projects.



IS BEGINNING . . .

"The Aeroplane" Photograph

NAPIER ELAND AIRLINER—an American Convair-Liner 340 which we have bought from the makers and converted from piston-engines to Napier Eland turbo-props. With the increased—but quieter—take-off power available, the aircraft can operate at an all-up weight of 53,200 lbs. instead of 47,000 lbs. and can carry its maximum payload of 12,880 lbs. over the much greater stage distance of 1,220 miles instead of 290 miles as in the case of the piston-engined version. The cruising speed is increased by 45 m.p.h. Apart from the change of engines modifications have been kept to a minimum. The Napier Eland Airliner will be flown on route proving trials and demonstration tours in Europe and the U.S.A.

In this Anglo-American enterprise we are not only demonstrating our confidence in the engine: we are also offering to the world's many Convair operators a simple way of giving new life, increased revenue and greater passenger appeal to their aircraft—by changing to Eland turbo-props.

Still higher powers to come

The Eland is years in the lead—and we are not sitting back and watching that lead melt away. We are applying what we have learned to the development of still higher powers—keeping the Eland always ahead of its time. The Era of the Eland is only just beginning!

HOW ARE YOU GOING TO USE THE ELAND TO YOUR ADVANTAGE?

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CRC E20

(Continued from page 137)

U.S. Civil Aircraft (Cont'd)

Mfr. & Model	Gross Weight (lbs.)	Oper. Empty Weight	Payload (lbs.)	Range—Max. (miles)	Fuel Cap. (Gals.)	Engines	Takeoff HP/Thrust	Rate of Climb (sea level, fpm)	ROC (One Eng. Out, S.L. fpm)	Cruising Speed mph.	Seating Provisions	Wing Loading (lbs. sq. ft.)	Power Loading (lbs./bhp)	Stall Speed (mph)	Wing Span	Length	Height	Capacities: Main Cabin (cu. ft.)	Auxiliary Comp'ts. Cabin (cu. ft.)	Other Cargo Holds (cu. ft.)
The Glenn L. Martin Co.																				
2-O-2	39,900	27,152	9,048	635	1,010	P&W (2) R2800 CA18	2,400	2,200	560	269	36	46	8.3	79	93' 3"	71' 4"	28' 5"	2,100		38
2-O-2A	43,000	28,869	7,631	1,135	1,350	P&W (2) R2800 CB16	2,400	1,885	382	270	36	49.8	8.96	79	93' 3"	71' 4"	28' 5"	2,100		83
4-O-4	44,900	32,339	11,592	600	1,350	P&W (2) R2800 CB16	2,400	1,905	385	256	40	51.9	9.3	81	93' 3"	74' 7"	28' 5"	2,250		107

Foreign Aircraft

Aviation Traders, Ltd.																				
Accountant Mk. I	28,500	16,190	6,000	1,790*	1,538	R-R Dart 512	3,450 eshp	1,500	530	293	30	44.3	5.48	76	82' 6"	60' 6"	24' 7"	1,275	150	
Mk. II	28,500	17,050	8,400	1,790*	1,538	R-R Dart 512	3,450 eshp	1,500	530	293	42	44.3	5.48	76	82' 6"	70' 6"	24' 7"	1,695	150	
Blackburn & General Aircraft, Ltd.																				
Beverley	143,000	84,740	50,000	470SM	8,260	Bristol Centaurus D.P.I.	3,150	760	320	173	162 tr. 4 crew	49	4.32	94	162'	99' 5"	37' 6"	4,990	2,070	430
Universal	143,000	81,740	50,000	660	5,770	Bristol Centaurus D.P.I.	3,150	760	320	173	162 tourist 2 crew	49	4.32	94	162'	99' 5"	37' 6"	4,990	2,070	430
Louis Breguet																				
Provence/ Deux Ponts	113,800		24,000	2,740	4,000	P&W (4) R-2800 CA-18	2,400	900	450	250	107	57	11.9	90	140'	95'	31' 8"	5,900		
Bristol Aeroplane Co.																				
170	44,000	27,229	16,045	250	1,400	Bristol Hercules 734	1,980	1,380	240	193	32/44	29.6	2.7	84	108'	68' 4"	26' 3½"	2,020	340	
250	170,000	84,850	31,000	4,940	10,191	Bristol Proteus 755	4,120			350/415	87	82	1.99		142' 3"	124' 3"	36' 8"	5,052	825	
310	170,000	83,250	28,000	4,940	10,191	Bristol Proteus 755	4,120			350/415	101	82	1.99		142' 3"	124' 3"	36' 8"	5,877		845
Canadair, Ltd.																				
North Star Argonaut	82,000		12,000	3,290		R-R (4) Merlin 724	1,760			232	40-57	55.1	11.7		117' 6"	93' 5"	27' 7"			
De Havilland Aircraft Co.																				
Comet 4	152,500	68,400	19,300	2,945	10,500	R-R (4) Avon RA29	10,500			500	60-76	71.9	19.8	108	115'	111' 5"	28' 5"	2,880	175	390
Heron 2E	13,500	8,484	3,460	550	495	de Hav. (4) Gipsy Queen 30 Mk2	250 bhp	1,075	565	183	14	27.1	13.5	75	71' 5"	48' 5"	15' 6"	515	22 fwd. 105 rear	
Dove 5	8,800	5,678	2,220	325	264	de Hav. (2) Gipsy Queen 70 Mk2	380	920	220	179	11	26.3	11.58	74	57' 0"	39' 3"	13' 6"	303	22 fwd 30 rear	
Dove 6A	8,800	6,040	1,840	370	264	de Hav. (2) Gipsy Queen 70 Mk2	380	920	220	179	6	26.3	11.58	74	57'	39' 3"	13' 6"	303	22 fwd 34 rear	
Ambassador/ Elizabethan	55,000	35,966	12,000	1,200	1,200	2 Bristol Centaurus	2,625	1,130	325	275	47	45.8	4.38	91-93	115'	82'	18 6"	2,200	300	
De Havilland Australia																				
Drover	6,500		1,700	580		Gipsy Major (3)	10,145	800		128	11	45.3	14.9		57'	36' 6"	10'			

De Havilland Canada																				
Otter	7,600		2,200	1,080		P&W (1) R1340	600	1,000		139	14	18.7	12.6		58'	42'	10' 6"			
Beaver	1,500					P&W (1) R985	450	1,100			5-7	20.4		42	48'	30' 3"	10' 7"			
Fokker Aircraft																				
F-27 Friendship	34,520		9,535	980		R-R (2) Dart 511	1,600	1,600	455	278	32-36	45.8			95'	76'	27' 5"		360	
Handley Page																				
Herald	34,000	20,322	10,705	1,000	700	Alvis Leonides Major (4)	870	1,300	710	207	44 tourist	38.55	9.77	80	35'	70' 3"	22' 6"	2,070	355	
Hermes	86,000	51,655	17,000	2,000	3,206	Bristol (4) Hercules 763	21,000	1,030	475	263	40-74	62.7	9.56	98.6	113'	96' 10"	30'	3,492		262
Hunting Percival																				
Prince 5	13,500	8,953	2,733	825	286	Alvis Leonides	520/540	950	170	150	6-12	33.7	2.7	79	64' 6"	46'	16'	620		
Pembroke	13,000	8,969	1,732	895	286	Alvis Leonides	525/540	980	150	150	6-10	32.5	2.7	75	64' 6"	46'	16'	620		
Hurel-Dubois																				
HD-32	39,600	23,000	13,170	1,450	955	P&W (2) R-1830	1,200	836	177	169	44	36.8	16.5	73.6	148' 6"	72' 2"	27' 10"	2,048		
HD-321	44,000	23,000	17,300	1,480	955	Wr. (2) 982 C 9 HE 1	1,525	975	226	172	44	40.9	14.4	77.7	148' 6"	72' 2"	27' 10"	2,048		
A. V. Roe																				
York	68,000		15,000	2,600		R-R (4) Merlin 500	1,610			206	35	52.4			102'	78'	20'			
Saunders-Roe																				
Princess	345,000	171,500	52,437	5,330	17,400	Bristol (6) B.E. 25	5,045	1,000		370	220	68.7			219' 6"	148'	55' 9"			
Scottish Aviation																				
Twin Pioneer	13,500	9,429	3,160	481	204	Alvis Leonides (2) 503/8	520/540	940	220	159	16	20.13	1.61	67	76' 6"	45' 3"	12' 3"	540	108	40
Short Bros. and Harland																				
Solent 4	81,000		6,390	2,900		Bristol (4) Hercules 753	2,020			230	45				112' 9½"	88' 7"	34' 3½"			
SNCA du Nord																				
Noratlas 2501	48,502	29,281	18,118	1,000		Bristol (2) Hercules 739	2,070	1,230		201	45	40.5	10.78		106' 7"	71' 8"	19' 8"			
SNCA du Sud-Est																				
Armagnac	165,348		38,581	4,040		P&W (4) R-4360	3,550			264	100	65			106' 7"	130'	44' 11"			
Caravelle	90,400	49,700	15,400	1,620nm (normal)		R-R (2) Avon RA29	10,500			481	70	63			112' 6"	104' 10"	28' 6"	6,000	600	280
Languedoc	52,250		9,500	1,600		P&W (4) R-1830	1,200			200	33-44				96' 5"	80' 7"	17'			
SNCA du Sud-Ouest																				
Bretagne	41,665		9,920	1,960		P&W (2) R-2800	2,000			229	42	45			88' 2"	62' 2"	16' 1"			
Svenska Aeroplan																				
Scandia	32,280		9,350	1,460		P&W (2) R-2180	1,800			236	32	38.2			91' 10"	69' 11"	23' 3"			
Vickers Armstrong																				
Viking	34,000	22,910	5,762	1,130	740	Hercules (2) 634	1,690	500	275	210	24-36	38.5	10.05	99	89' 3"	65' 2"	24'	1,435	170	270
Viscount 700D	60,000	36,700	11,600	2,170	2,360	Dart RDa6 Mk. 510	1,780	1,280	740	325	40-59	62.3	8.45	122	93' 8½"	81' 9"	27' 9"	1,775	595	215
Viscount 700	60,000	35,900	12,400	2,000	2,360	Dart RDa6 Mk. 510	1,550	1,180	630	320	40-59	62.3	9.7	122	93' 8½"	81' 9"	27' 9"	1,775	595	215
Viscount 803	62,000	38,950	12,900	1,955	2,360	Dart RDa6 Mk. 510	1,780	1,250	700	320	48-65	64.4	8.70	125	94'	85'	26' 9"	2,500	490	270
Viscount 810	67,500	39,890	14,000	1,970	2,270	Dart RDa7/1	1,800			365	52+	70.10			94'	85' 7"	26' 9"	2,500	490	270
Viscount 840	69,000	40,262	14,000	1,950	2,270	Dart RDa8	1,800			400	52+	71.70			94'	85' 7"	26' 9"	2,500	490	270
Vanguard	100,000		20,000	2,500		R-R Tyne	4,000			400-425	93+				118' 7"	118' 1"	34' 11"			

Transatlantic Travel Made Record Gain in '55

Transatlantic air travel in 1955 showed its biggest gain since 1952, the year in which tourist service was introduced.

A total of 652,233 first-class and tourist passengers used the regular schedules (charters not included) of the 13 U.S. and foreign airlines flying routes between the U.S., Canada and Europe. This was an 18.58% increase over the 550,000 passengers of 1954. The 1954 gain over 1953 was only 8.56%; 1953 over 1952 was 17.6%, and 1952 over 1951 was 30.9%. Atlantic totals do not include transpolar traffic of Scandinavian Airlines System.

The year was marked by a tremendous surge by Pan American World Airways, which not only continued as the top carrier of first-class passengers, but which took over the tourist lead from TWA and the cargo lead from KLM Royal Dutch Airlines. Last year also saw the inauguration of service by Germany's Deutsche Lufthansa and by Airwork, British all-cargo line. Airwork, however, discontinued flying in December.

• **The shift** from first-class to tourist continued, but at a slower rate. Of the 652,233 passengers traveling in both directions between the U.S., Canada and Europe, 462,555, or 70.9% were on low-fare flights, compared with 69.1% of the 1954 total. Out of 1,006,492 seats offered for sale, 71.1% were tourist.

Collectively, the airlines operated at a 64.80% load factor (65.28% first-class, 64.60% tourist).

Of the total traffic, PAA and TWA carried 48.2% (46.4% in 1954), with the other flag carriers splitting 51.8%. The two U.S. lines offered 45.6% of the seats.

Excluding Canada-Europe business of Trans-Canada, KLM and BOAC, and counting only U.S.-Europe, PAA and TWA carried 53.8% of the traffic and offered 50.5% of the seats.

• **Total tourist travel** showed a 21.7% gain, up from 380,176 in 1954 to 462,555 last year. On the U.S.-Europe route, the increase was 23.8%. A total of 715,962 tourist seats was offered for sale, 17% more than 1954 (18.5% more from U.S.).

In contrast to 1954, first-class business gained 11.7% (12.5% U.S.-Europe only). In 1954, first-class passengers had dropped 8.7% from the 1953 total (down 9.3% U.S.-Europe).

Cargo Up 30.5%

Cargo registered a substantial 30.5% increase, from 10,938.5 tons to 14,277.9 tons (1954 over 1953 was 12%). U.S.-Europe cargo traffic was up 33.6%. Foreign flag lines carried 64.9% of all cargo. PAA, however, took over the top spot from KLM, hauling 3,408.7 tons to the Dutch carrier's 2,945.4 (the latter figure includes Canada-Europe). PAA boosted its all-freight flights from 145 in 1954 to 380, while KLM dropped from 304 to 265.

Mail continued to gain at a satisfactory rate, totaling 8,213.7 tons, up 23.3%. PAA and TWA carried 65.9% of the tonnage. To and from the U.S. they hauled 71.1%.

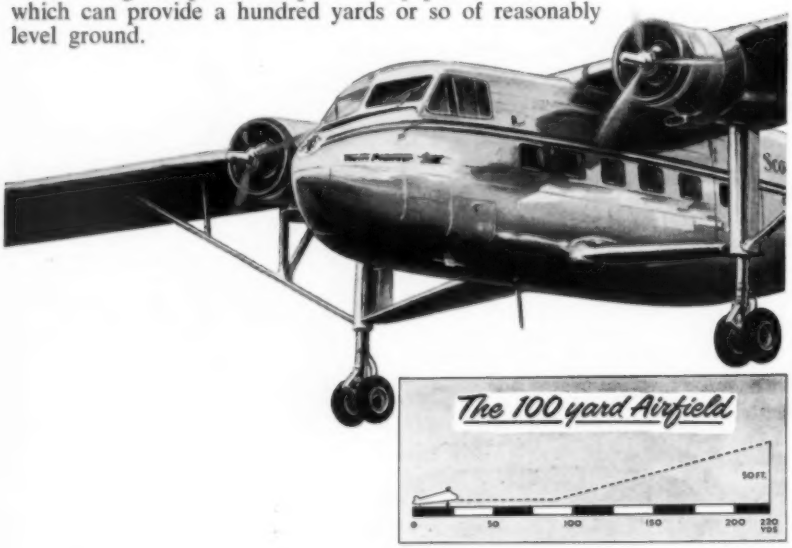
• **The top five carriers** of first-class passengers last year, in order, were: PAA, BOAC, TWA, Air France and KLM. In the tourist field it was PAA, TWA, SAS, KLM and Air France. For both classes of traffic, PAA, TWA, BOAC, KLM and SAS.

Extent of PAA's gains can be seen from the fact that it added 13.9% more first-class seats in 1955 and upped its first-class business 18%. Tourist was more spectacular, seats increasing 31.7% and traffic 47.4%. Of the 652,233 transatlantic passengers last year, 187,104, or 28.6%, were carried by PAA.

16 Passenger

Twin Pioneer

—can bring cheap air transport to any part of the world which can provide a hundred yards or so of reasonably level ground.



A fixed wing, 16-passenger or 4,000 lbs freight carrying aircraft that can take-off in 85 yards and land in 90 yards. The Twin Pioneer cruises at 140 miles an hour . . . Range 620 miles . . . Maximum speed 180 miles per hour . . . and lands at bicycle speed.

The Twin Pioneer aircraft is specially designed to meet the need of difficult territories where airfields can neither be constructed nor afforded and for short range inter-city air services where much time can be saved by operating from strips close in to the centres of cities.

SCOTTISH AVIATION

PRESTWICK AIRPORT, AYRSHIRE, SCOTLAND • Telegrams: AERONAUTICS • PRESTWICK

Air Traffic Both Ways Between U.S., Canada and Europe, 1955

	UNITED STATES TRAFFIC													U.S. TOTAL	CANADIAN TRAFFIC			Canada TOTAL	GRAND TOTAL	
	AF	Airwk*	BOAC	Lufthansa†	El Al	Iberia	KLM	LAI	PAA	SABENA	SAS	Swiss	TWA		BOAC	KLM	TCA			
Rev. Pass.	15,356	0	26,759	1,592	0	2,484	14,050	3,454	64,257	3,219	11,078	5,726	26,365	174,340	7,307	2,503	5,528	15,338	189,678	FIRST CLASS
Seat Capacity ...	24,798	0	40,555	4,636	0	8,643	22,953	8,321	90,035	5,576	17,085	7,289	36,816	266,707	12,604	3,640	7,579	23,823	290,530	
% Seats Used ..	61.92	0	65.98	34.33	0	28.74	61.21	41.50	71.36	57.72	64.84	78.55	71.61	65.36	57.97	68.76	72.93	64.38	65.28	
1st Class Flts. ..	90	0	790	0	0	0	477	48	1,542	2	391	102	1,333	4,775	221	0	0	221	4,996	
Mixed Flts.	579	0	33	274	0	279	255	397	1,389	453	431	446	70	4,906	62	296	694	1,052	5,958	
Cargo Flts.	0	222	25	0	0	0	265	0	380	2	0	87	121	1,102	0	0	0	0	1,102	
Cargo (tons) ...	785.4	771.9	966.0	130.3	120.1	30.0	2,697.7	296.8	),408.7	586.7	832.2	813.2	1,596.1	13,035.1	242.8	247.7	752.3	1,242.8	14,277.9	
Mail (tons)	361.1	0	631.5	138.4	26.3	38.6	141.4	149.1	2,907.3	157.6	323.6	230.0	2,506.2	7,611.1	223.5	48.4	330.7	602.6	8,213.7	
Rev. Pass.	30,083	0	24,879	5,421	7,325	4,873	32,772	9,711	122,847	19,774	35,183	16,440	100,857	410,165	14,964	8,687	28,739	52,390	462,555	FIRST CLASS TOUR. COMB.
Seat Capacity ...	42,591	0	39,245	12,490	12,888	11,165	56,054	18,332	189,291	34,677	56,121	26,080	142,945	641,879	23,631	12,980	37,472	74,083	715,962	
% Seats Used ..	70.63	0	63.39	43.40	56.83	43.64	58.46	52.97	64.89	57.02	62.69	63.03	70.55	63.90	63.32	66.92	76.69	70.71	64.60	
No. of Flts.	192	0	470	0	222	0	750	0	1,854	267	532	64	2,436	6,787	255	5	0	260	7,047	
Rev. Pass.	45,439	0	51,638	7,013	7,325	7,357	46,822	13,165	187,104	22,993	46,261	22,166	127,222	584,505	22,271	11,190	34,267	67,728	652,233	
Seat Capacity ...	67,389	0	79,800	17,126	12,888	19,808	79,007	26,653	279,326	40,253	73,206	33,369	179,761	908,586	36,235	16,620	45,051	97,906	1,006,492	
% Seats Used ...	67.42	0	64.70	40.94	56.83	37.14	59.26	49.39	66.98	57.12	63.19	66.42	70.77	64.33	61.46	67.32	76.06	69.17	64.80	
No. of Flts.	1,161	0	1,293	274	222	279	1,482	445	4,785	722	1,354	612	3,839	16,468	538	301	694	1,533	18,001	

Air Traffic Eastbound Between U.S., Canada and Europe, 1955

	UNITED STATES TRAFFIC													U.S. TOTAL	CANADIAN TRAFFIC			Canada TOTAL	GRAND TOTAL	
	AF	Airwk*	BOAC	Lufthansa†	El Al	Iberia	KLM	LAI	PAA	SABENA	SAS	Swiss	TWA		BOAC	KLM	TCA			
Rev. Pass.	7,506	0	13,423	696	0	1,241	7,372	1,749	31,712	1,687	5,769	2,996	13,072	87,223	3,551	1,176	2,665	7,392	94,615	FIRST CLASS
Seat Capacity ...	12,421	0	20,207	2,336	0	4,365	11,463	4,172	44,689	2,790	8,582	3,661	18,450	133,136	6,348	1,860	3,746	11,954	145,090	
% Seats Used ...	60.43	0	66.43	29.79	0	28.43	64.31	41.92	70.96	60.46	67.22	81.83	70.85	65.51	55.94	63.22	71.14	61.84	65.21	
1st Class Flts. ..	45	0	392	0	0	0	235	24	770	1	193	51	665	2,376	111	0	0	111	2,487	
Mixed Flts.	440	0	17	140	0	141	134	198	699	226	217	222	35	2,469	31	148	343	522	2,991	
Cargo Flts.	0	109	17	0	0	0	142	0	195	1	0	42	62	568	0	0	0	0	568	
Cargo (tons) ...	463.9	325.2	591.6	20.1	56.0	14.7	1,162.8	133.8	1,191.8	253.3	420.7	356.6	587.0	5,577.5	67.1	57.1	224.5	348.7	5,926.2	
Mail (tons)	81.2	0	82.2	14.4	11.5	19.2	20.5	14.1	1,993.1	22.7	53.1	35.9	1,607.2	3,955.1	19.9	9.8	299.3	328.9	4,284.0	
NOTE: Cargo and mail totals include tonnage carried on first class, tourist, mixed and all-cargo flights.																				
Rev. Pass.	14,661	0	11,953	2,159	3,708	2,356	16,300	4,361	56,834	9,657	16,858	8,378	47,353	194,578	6,925	3,795	13,961	24,681	219,259	FIRST CLASS TOUR. COMB.
Seat Capacity ...	21,409	0	20,840	6,397	6,386	5,640	28,255	9,113	95,952	17,272	27,928	13,028	72,019	324,239	11,535	6,474	18,518	36,527	360,766	
% Seats Used ...	68.48	0	57.36	33.75	58.06	41.77	57.69	47.85	59.23	55.91	60.36	64.31	65.75	60.01	60.03	58.62	75.39	67.57	60.77	
No. of Flts.	99	0	247	0	110	0	375	0	952	129	269	34	1,228	3,443	126	3	0	129	3,572	
Rev. Pass.	22,167	0	25,376	2,855	3,708	3,597	23,672	6,110	88,546	11,344	22,627	11,374	60,425	281,801	10,476	4,971	16,626	32,073	313,874	
Seat Capacity ...	33,830	0	41,047	8,733	6,386	10,005	39,718	13,285	140,641	20,062	36,510	16,689	90,469	457,375	17,883	8,334	22,264	48,481	505,856	
% Seats Used ..	65.52	0	61.82	32.69	58.06	35.95	59.60	45.99	62.96	56.54	61.97	68.15	66.79	61.61	58.58	59.65	74.68	66.15	62.05	
No. of Flts.	584	0	656	140	110	141	744	222	2,421	356	679	307	1,928	8,288	268	151	343	762	9,050	

NOTE: Total number of flights includes first class, tourist and mixed.

Air Traffic Westbound Between U.S., Canada and Europe, 1955

	UNITED STATES TRAFFIC													U.S. TOTAL	CANADIAN TRAFFIC			Canada TOTAL	GRAND TOTAL	
	AF	Airwk*	BOAC	Lufthansa†	El Al	Iberia	KLM	LAI	PAA	SABENA	SAS	Swiss	TWA		BOAC	KLM	TCA			
Rev. Pass.	7,850	0	13,336	896	0	1,243	6,678	1,705	32,545	1,532	5,309	2,730	13,293	87,117	3,756	1,327	2,863	7,946	95,063	FIRST CLASS
Seat Capacity ...	12,377	0	20,348	2,300	0	4,278	11,490	4,149	45,346	2,786	8,503	3,628	18,366	133,571	6,256	1,780	3,833	11,869	145,440	
% Seats Used ...	63.42	0	65.53	38.95	0	29.05	58.12	41.09	71.77	54.98	62.43	75.24	72.37	65.22	60.03	74.55	74.69	66.94	65.36	
1st Class Flts. ..	45	0	398	0	0	0	242	24	772	1	198	51	668	2,399	110	0	0	110	2,509	
Mixed Flts.	439	0	16	134	0	138	121	199	690	227	214	224	35	2,437	31	148	351	530	2,967	
Cargo Flts.	0	113	8	0	0	0	123	0	185	1	0	45	59	534	0	0	0	0	534	
Cargo (tons) ...	321.5	446.7	374.4	110.2	64.1	15.3	1,534.9	163.0	2,216.9	333.4	411.5	456.6	1,009.1	7,457.6	175.7	190.6	527.8	894.1	8,351.7	
Mail (tons)	279.9	0	549.3	124.0	14.8	19.4	120.9	135.0	914.2	134.9	270.5	194.1	899.0	3,656.0	203.6	38.6	31.5	273.7	3,929.7	
Rev. Pass.	15,422	0	12,926	3,262	3,617	2,517	16,472	5,350	66,013	10,117	18,325	8,062	53,504	215,587	8,039	4,892	14,778	27,709	243,296	FIRST CLASS TOUR. COMB.
Seat Capacity ...	21,182	0	18,405	6,093	6,502	5,525	27,799	9,219	93,339	17,405	28,193	13,052	70,926	317,640	12,096	6,506	18,954	37,556	355,196	
% Seats Used ...	72.80	0	70.23	53.53	55.62	45.55	59.25	58.03	70.72	58.12	64.99	61.76	75.43	67.87	66.45	75.19	77.96	73.78	68.49	
No. of Flts.	93	0	223	0	112	0	375	0	902	138	263	30	1,208	3,344	129	2	0	131	3,475	
Rev. Pass.	23,272	0	26,262	4,158	3,617	3,760	23,150	7,055	98,558	11,649	23,634	10,792	66,797	302,704	11,795	6,219	17,641	35,655	338,359	
Seat Capacity ...	33,559	0	38,753	8,393	6,502	9,803	39,289	13,368	138,685	20,191	36,696	16,680	89,292	451,211	18,352	8,286	22,787	49,425	500,636	
% Seats Used ...	69.34	0	67.76	49.54	55.62	38.35	58.92	52.77	71.06	57.69	64.40	64.70	74.80	67.08	64.27	75.05	77.41	72.13	67.58	
No. of Flts.	577	0	637	134	112	138	738	223	2,364	366	675	305	1,911	8,180	270	150	351	771	8,951	

** Airwork figures cover March-December.*
† Lufthansa figures cover July-December.

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...USES TODAY'S GROUND ORGANIZATION

THE TWIN-JET "CARAVELLE" IS THE MEDIUM-RANGE AIRCRAFT OF TOMORROW

because:

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And the cost per seat-mile is the lowest in the world.

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because:

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U.S. Airline Transports

Scheduled Domestic Operations

Cert. No.	OPERATOR	Douglas DC-7	DC-6	DC-6A	DC-6B	DC-4	DC-3	Viscount -744	Lockheed -1049	749	049	18	Martin -404	-202	Boeing -377	Convair -340	-240	Totals
105	Allegheny	..	..	..	..	..	14	..	..	..	..	..	..	4	..	..	..	18
25	American	25	50	3	25	9	..	..	..	..	..	..	..	..	..	..	74	186
604	Bonanza	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..	5
18	Braniff	..	9	..	..	..	23	..	..	..	..	..	..	..	..	25	..	57
21	Capital	..	..	..	..	24	21	8	..	..	12	..	..	..	..	..	..	65
404	Central	..	..	..	..	..	9	..	..	..	..	..	..	..	..	..	..	9
23	Colonial	..	..	..	..	5	8	..	..	..	..	..	..	..	..	..	..	13
14	Continental	..	..	..	3	..	21	..	..	..	..	..	..	..	..	6	..	30
26	Delta	11	7	..	..	..	16	..	..	..	..	..	..	..	..	20	..	54
10	Eastern	***12	..	..	2	9	..	..	*27	19	..	..	60	..	..	..	..	129
501	Frontier	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	12
306	Lake Central	..	..	..	..	..	7	..	..	..	..	..	..	..	..	..	..	7
104	Mohawk	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	4	14
16	National	4	4	..	8	..	..	..	..	..	..	9	..	..	..	12	..	37
303	North Central	..	..	..	..	..	18	..	..	..	..	..	..	..	..	..	..	18
15	Northeast	..	..	..	..	..	11	..	..	..	..	..	..	..	..	..	6	17
20	Northwest	..	..	5	4	17	7	..	**4	..	..	..	..	..	10	..	..	47
308	Ozark	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..	14
208	Piedmont	..	..	..	..	..	17	..	..	..	..	..	..	..	..	..	..	17
209	Southern	..	..	..	..	..	12	..	..	..	..	..	..	..	..	..	..	12
601	Southwest	..	..	..	..	..	10	..	..	..	..	..	..	4	..	..	..	14
401	Trans-Texas	..	..	..	..	..	16	..	..	..	..	..	..	..	..	..	..	16
17	T. W. A. (Domestic)	..	..	..	..	11	..	..	**30	39	32	..	40	11	..	..	..	163
11	United	25	42	..	20	19	13	..	..	..	..	..	..	..	..	55	..	174
702	West Coast	..	..	..	..	..	13	..	..	..	..	..	..	..	..	..	..	13
28	Western	..	..	..	8	6	8	..	..	..	..	..	..	..	..	..	9	31
	Trunk & Feeder TOTAL	77	112	8	70	100	285	8	61	58	44	9	100	19	10	118	93	1172

	"Cargo Only"	Douglas DC-7	DC-6	DC-6A	DC-6B	DC-4	DC-3	Viscount -744	Lockheed -1049	749	049	18	Martin -404	-202	Boeing -377	Convair -340	-240	Curtiss C-46	Helicopter S-51	S-55	47D	47G	Tls.
203	Aerovias Sud	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	6
605	Flying Tiger	..	..	4	..	4	..	..	..	..	..	..	..	..	..	..	..	18	..	..	..	..	26
212	Riddle	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	16
606	Slick	..	..	3	..	3	..	..	..	..	..	..	..	..	..	..	..	17	..	..	..	..	23
201	U.S. Airlines	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0	..	..	..	..	0
	INTRASTATE																						
6-4	(C) California Cent.	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3
6-6	(C) Friedkin Aeronautics	..	..	..	..	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3
FW-8	Capitol Airways	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4
	HELICOPTERS																						
	Helicopter Air Service	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	6	6
	Los Angeles Airways	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	5	..	..	7
	New York Airways	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..	1	6
	"Cargo Only" Intrastate, & Helicopters, TOTAL	0	0	7	0	9	8	0	0	0	0	0	0	0	0	0	0	57	2	10	0	7	100
	Aircraft on Trunk & Feeder Certificates	77	112	8	70	100	285	8	61	58	44	9	100	19	10	118	93	0	0	0	0	0	1172
	Aircraft on Helicopters, "Cargo Only," & Intrastate Certificates	0	0	7	0	9	8	0	0	0	0	0	0	0	0	0	0	57	2	10	0	7	100
	Aircraft on all Domestic Certificates	77	112	15	70	109	293	8	61	58	44	9	100	19	10	118	93	57	2	10	0	7	1272

* Includes 16 L-1049C. ** Includes 24 L-1049G (4 NWA: 20 TWA). *** DC-7B.

Santiago, Chile, famous for seafood, served with fine Chilean wine.

You haven't seen anything till you've seen

South America

overnight from New York via PANAGRA DC-7B

In New York, board the only DC-7B to South America's West Coast and Argentina.

You'll be in Buenos Aires 4 hours faster than by any other service when you fly with Panagra. You can save hours to Lima and Santiago too.

No change of plane from New York by *El InterAmericano* DC-7B or *El Pacifico* DC-6B. Both fly daily over routes of National Airlines, Pan American and Panagra. Call your Travel Agent, National, or Pan American, Panagra's U.S. Sales Agent.

Pan American-Grace Airways

PANAGRA

WORLD'S FRIENDLIEST AIRLINE

New Transports, Nonstop Operations Push Average Speeds Above 300 mph

Although virtually every transport introduced in the postwar era has carried a manufacturer's guaranteed cruising speed in excess of 300 mph, actual speeds averaged by an airline from takeoff to landing necessarily run far below that figure.

Just how far below varies with the route structure of a particular carrier, the big factor being the percentage of time spent in climbing and descending from cruise altitude. In these operations speeds range well below the 200 mph mark even for the fastest transports.

Only with the introduction of newer, high speed aircraft and nonstop coast-to-coast operations have carriers managed to pass the 300 mph average from wheel-off to touchdown for an airplane type. During 1955, three airlines all flying DC-7s (United, American and Panagra) recorded average speeds of 307.1, 306.4 and 300.7 mph. UAL and AA operated DC-7s, Panagra DC-7Bs.

• **Two other aircraft** new to domestic U.S. scheduled airline operations were written into the record during 1955. Capital Airlines, introducing its turboprop Vickers Viscount in Washington-Chicago service, averaged 255.6 mph in 3,671 hours and 938,435 miles of flying. Braniff Airways averaged 196.6 mph with a cargo C-46 flying 94 hours and 18,478 miles following its introduction late in '55.

DOUGLAS DC-3

Take-off to Landing

Airline	Revenue Flight Hours	Revenue Miles	Average Speed
AAA	30,557	4,278,154	140
BAL	15,937	2,342,576	147
BNF	49,916	7,888,197	158
CAI	21,336	2,912,659	136.5
CAL	45,189	6,945,514	153.7
CAP	52,658	7,517,071	142.8
CBA	5,570	800,343	143.7
CEN	18,215	2,649,052	145.4
DAL	36,508	5,422,481	148.5
FAL	32,436	4,864,092	150.0
HAL	10,113	1,495,900	147.9
LCA	16,009	2,206,844	137.9
MOH	22,593	3,057,096	135.3
NEA	29,109	4,112,764	141.3
NOR	44,320	6,414,950	144.7
NWA	18,021	2,590,601	143.8
OZA	28,795	4,113,535	142.9
PAI	44,303	6,451,013	145.6
Panagra	2,850	460,559	161.6
SOU	21,936	3,263,651	148.8
SWA	16,027	2,192,336	136.8
TPA	11,378	1,706,010	149.9
TTA	28,989	4,350,693	150.1
UAL	17,598	2,440,161	138.7
WAL	21,421	3,276,745	153
WCA	25,989	3,460,802	133.2

DOUGLAS DC-4

AA	12,709	2,400,499	188.9
CAI	15,129	2,827,919	186.9
CAP	79,891	14,652,752	183.4
NWA	54,403	10,413,542	191.4
PAA-ALA	3,208	650,861	202.9
-ATL	18,438	3,373,000	182.9
-LAD	26,318	5,401,893	205.3
-PAC	8,070	1,957,910	242.6
Panagra	1,897	340,220	179.3
TWA	22,630	4,276,723	189.0
UAL	47,712	9,202,266	192.9
WAL	20,066	3,725,577	185.7

DOUGLAS DC-6

AA	236,901	59,276,390	250.2
BNF	13,008	3,251,192	249.9
CAL	3,950	992,870	251.4
DAL	27,360	6,917,011	252.8
NAL	17,143	4,340,100	253.2
PAA-LAD	2,639	677,669	256.8
Panagra	5,507	1,465,496	266.1
UAL	136,485	34,918,865	255.8

DOUGLAS DC-6A

AA	6,935	1,750,537	253.1
PAA-ATL	3,122	776,000	248.6
-LAD	6,789	1,822,298	268.4

DOUGLAS DC-6B

CAL	3,487	894,337	256.5
NWA	25,259	6,567,010	260.0

(*Continued on page* 149)

Louis Breguet

AIRCRAFT

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TACTICAL S.T.O.L. TRANSPORT

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BREGUET 765 DOUBLE DECKER

MILITARY TRANSPORT

Circle No. 58 on Reader Service Card.

SLICK AIRWAYS' OWN Annual Report on Air Transportation Progress

This year, SLICK marks a gratifying decade of specialized all-cargo service to the airshipper.

It chooses the occasion to promise a continuance and enlargement of that service ... to rededicate itself to the progress in business and higher standards of living that air transport makes possible ... to re-state its basic policy of bringing the best in transportation at reasonable rates to the nation and the nation's shippers

D. W. RENTZEL, PRESIDENT

(*Continued from page 147*)

Airline	Revenue Flight Hours	Revenue Miles	Average Speed
PAA-ALA	9,757	2,457,355	251.9
-ATL	66,813	16,557,000	247.8
-LAD	48,485	12,722,252	262.4
-PAC	8,070	1,957,910	242.6
Panagra	8,207	2,110,022	257.1
UAL	64,292	16,294,577	253.4
WAL	25,983	6,402,018	246.4
DOUGLAS DC-7			
AA	77,250	23,668,816	306.4
DAL	25,319	7,411,583	292.7
NAL	14,307	4,186,556	292.6
UAL	82,628	25,372,265	307.1
DOUGLAS DC-7B			
EAL			
NAL	827	237,815	287.6
PAA-ATL	11,439	3,246,000	283.8
Panagra	3,031	911,303	300.7
LOCKHEED L-49			
BNF	1,067	250,303	234.6
TWA	108,500	26,178,094	241.3
PAA-LAD	10,364	2,410,337	232.6
LOCKHEED 649/749			
CAP	33,960	7,590,589	232.5
NAL	2,769	679,225	245.3
TWA	120,780	29,500,744	244.3
LOCKHEED 1049			
TWA	27,771	7,584,147	273.1
LOCKHEED 1049G			
NWA	9,392	2,396,273	255.1
TWA	32,837	9,225,178	280.9
BOEING 377			
NWA	31,962	8,003,630	250.4
PAA-ATL	25,866	6,522,000	252.1
-PAC	56,147	14,765,014	263.0
CONVAIR 240			
AA	178,541	34,589,362	193.7
MOH	2,724	490,473	180.1
NEA	13,041	2,462,957	188.9
WAL	23,966	4,930,606	206
PAA-LAD	8,560	1,822,252	219.9
CONVAIR 340			
BNF	65,076	13,708,904	210.7
DAL	54,832	11,346,855	206.9
HAL	7,941	1,551,350	195.4
NAL	30,755	6,092,709	198.1
UAL	110,665	21,799,967	197.0
MARTIN 2-0-2/2-0-2A			
AAA	2,660	456,750	171.7
SOU	6,444	1,124,121	174.4
MARTIN 4-0-4			
TWA	106,337	20,051,688	188.6
CURTISS C-46			
BNF	94	18,478	196.6
VICKERS VISCOUNT			
CAP	3,671	938,435	255.6
BELL 47G			
HAS	6,362	335,571	52.7

U.S. Airline Transports

Scheduled International Operations

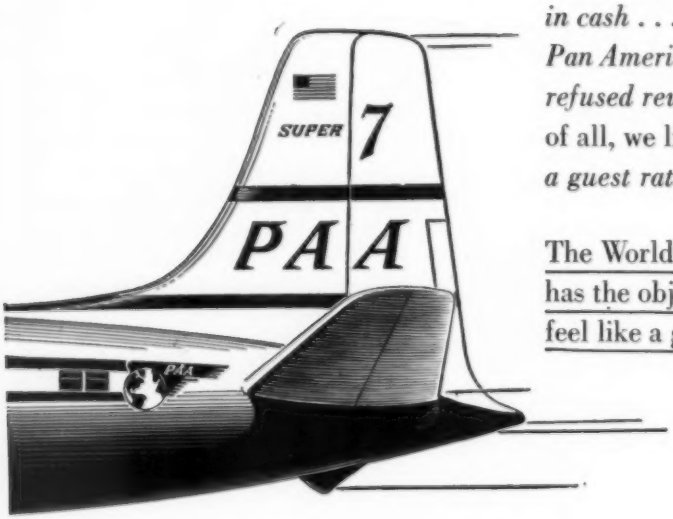
Cert. No.	OPERATOR	Douglas DC-7	DC-6	DC-6A	DC-6B	DC-4	DC-3	Lockheed 1049	749	649	049	18	Boeing 5C	—377	Convair —340	240	Curtiss C-46	Miscellaneous G-44	G-21A	Misc.[1]	Tls.
802	Alaska	..	..	..	..	2	3	..	..	..	..	..	..	..	..	..	***2	..	..	..	7
804	Alaska Coastal	..	..	..	..	..	..	..	..	..	..	..	1	..	..	..	..	..	9	2	12
25	American	*25	*50	*3	*25	*9	..	..	..	..	..	..	..	..	..	*74	..	..	..	..	186
402F	Braniff	..	*9	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9
32	Caribbean	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	4
102F	Colonial	..	..	..	..	*5	*8	..	..	..	..	..	..	..	..	..	..	..	..	..	13
808	Cordova	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	1	..	..	3
202F	Delta	*11	*7	..	..	..	*16	..	..	..	..	..	..	..	*20	..	..	..	..	..	54
201F	Eastern	*12	..	..	*2	*6	..	*27	*19	..	..	..	..	..	..	..	..	..	..	..	66
805	Ellis	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	..	7
5	Hawaiian	..	..	..	..	..	10	..	..	..	..	..	..	..	5	..	..	..	..	..	15
1001F	Mackey	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..	..	..	..	4
1002F	Midet	..	..	..	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	1
203F	National	*4	*4	..	*8	..	..	..	..	..	..	*9	..	..	*12	..	..	..	..	..	37
803	Northern Cons.	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	3
301F	Northwest	..	..	*5	*4	*17	..	*4	..	..	..	..	..	*10	..	..	..	..	..	..	40
801	Pacific Northern	..	..	..	..	2	4	..	..	3	..	..	..	..	..	..	..	..	..	..	9
8	Panagra	5[2]	..	..	5	2	5	..	..	..	..	..	..	..	..	..	..	..	..	..	17
1	Pan American-AD	..	4	3£	44£	21‡	..	..	..	..	5†	..	..	§	..	..	..	..	..	..	77
4&6	Pan American-LAD	..	..	£	£	‡	4	..	..	..	†	..	..	10§	..	5	..	..	..	..	19
2&3	Pan American-PAD	..	..	..	4	5	..	..	..	..	†	..	..	16 (Cert. 3)	..	..	..	..	..	..	25
807	Reeve Aleutian	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	1	4
211	Resort	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	**7	..	..	..	7
901	Trans Pacific	..	..	..	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	6
34	TWA (International)	..	..	..	..	*2	..	..	*27¶	..	..	..	..	..	..	..	..	..	..	..	29
302F	United	*7	*6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	13
806	Wien Alaska	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	3	..	..	..	5
In International Service TOTAL		64	80	11	92	71	75	31	46	3	5	9	1	36	37	79	12	1	16	3	672

* Also listed on Domestic Certificate.
** Operated in accordance with Provisions Special CAR No. SR-373A.
*** Operated in accordance with CAR No. SR-368A.
[1] Includes 1, Ch300; 1, PBy and 1, S-43.
[2] DC-7B.
† Listed on Certificates 1 and 3.
‡ DC4's shown on Certificate 1 are also operated on Cert. 6.
§ B-377's shown on Certificate 6 are listed on 1.
¶ 12 additional L-749's shown on Domestic Cert. No. 17.
£ Same aircraft listed on Certificates 1 & 6.

Some leaders lose the personal touch

So Pan American World Airways has a rule that individual attention must be paid to every one of the thousands of letters which are received every month... And when a passenger writes: "*You have succeeded in keeping the personal touch*"—and when another passenger writes: "*Everywhere that wonderful spirit of friendly helpfulness made all passengers feel right at home*" — well, we feel pretty good!

"*I found I had lost my billfold in Berlin... valuable papers... over six hundred dollars in cash... Hotel guides very indifferent but Pan American recovered my billfold... refused reward.*" — And perhaps best of all, we like: "*Gave me a feeling of being a guest rather than a passenger*"—



The World's Most Experienced Airline has the objective of making *every* passenger feel like a guest.

Carrying the Stars and Stripes to 80 countries and colonies 'round the world

PAN AMERICAN
WORLD'S MOST EXPERIENCED AIRLINE

Scheduled Airline Revenues and Expenses, 1955-1954

DOMESTIC TRUNK LINES

	Passenger Revenues 1955	Passenger Revenues 1954	Freight Revenues 1955	Freight Revenues 1954	Express Revenues 1955	Express Revenues 1954	Mail Revenues 1955	Mail Revenues 1954	Total Operating Revenues 1955	Total Operating Revenues 1954	Total Operating Expenses 1955	Total Operating Expenses 1954	Net Operating Income 1955	Net Operating Income 1954
American	$ 227,505,952	$185,879,413	$14,631,865	$11,788,560	$4,461,329	$ 3,232,444	$ 5,839,667	$ 6,448,492	$ 255,390,974	$210,342,067	$ 217,004,569	$189,262,687	$ 38,386,405	$21,079,380
Braniff	36,245,709	31,016,420	1,003,638	843,015	555,521	457,649	934,383	1,934,136	39,535,356	35,184,786	35,665,138	31,559,305	3,870,218	3,625,481
Capital	45,897,106	43,081,848	1,172,259	1,158,788	1,155,292	961,819	1,217,250	1,259,272	50,849,876	48,136,745	50,355,795	45,738,344	494,081	2,398,401
Caribair	1,157,502	1,020,639	42,126	34,114	.....	.....	17,993	105,277	1,335,543	1,230,815	1,293,456	1,144,468	42,087	86,347
Colonial	6,969,932	6,331,315	155,718	115,147	41,304	29,094	77,154	577,032	7,787,265	7,179,966	7,921,645	7,216,224	—134,380	—36,258
Continental	13,790,391	10,511,596	410,519	268,486	134,746	95,902	374,191	827,633	16,082,839	12,119,884	15,137,536	11,077,737	945,303	1,042,147
Delta	52,843,394	44,891,378	1,767,287	1,472,779	975,291	874,487	1,289,761	1,607,338	57,871,530	49,578,188	50,439,076	44,931,728	7,432,454	4,646,460
Eastern	174,822,644	149,464,668	2,726,326	2,107,448	2,264,626	1,711,183	3,625,045	3,458,257	187,898,687	160,381,288	163,141,268	142,347,752	24,757,419	18,033,536
Hawaiian	3,896,692	3,680,976	677,649	666,159	.....	.....	37,162	399,821	5,092,468	4,847,968	5,355,826	5,284,318	—263,358	—436,350
National	43,073,773	35,225,679	1,097,500	1,102,398	299,154	243,147	514,266	979,251	46,965,119	39,282,308	39,693,187	35,692,099	7,271,932	3,590,209
Northeast	7,938,798	7,118,264	220,494	186,974	96,362	85,857	131,247	1,946,748	10,120,300	9,451,204	9,971,913	9,281,280	1,148,387	169,924
Northwest	44,555,282	40,367,458	1,909,291	1,410,026	976,006	732,776	1,575,290	1,369,157	50,006,229	44,605,826	45,346,044	41,300,390	4,660,185	3,305,436
Trans Pacific	1,789,406	1,589,277	75,194	66,412	.....	4,437	10,656	241,227	2,021,591	1,942,139	1,980,148	1,795,785	41,443	146,354
TWA	135,089,655	129,021,722	5,065,452	4,694,907	2,851,975	2,584,784	4,326,467	6,156,506	149,954,417	145,104,742	134,189,828	126,963,024	15,764,589	18,141,718
United	196,705,404	166,790,879	8,642,182	7,341,461	4,825,308	3,781,631	7,042,477	9,594,109	222,128,046	191,314,338	201,221,528	169,882,520	20,906,518	21,431,818
Western	28,755,616	22,423,388	653,823	510,488	343,492	303,083	862,014	763,586	31,039,523	24,405,899	26,648,756	22,372,369	4,390,767	2,033,530
TOTALS	1,021,037,256	878,414,920	40,251,323	33,767,162	18,980,406	15,098,293	27,875,023	37,667,842*	1,134,079,763	985,108,163	1,005,365,713	885,850,030	129,714,050	99,258,133

INTERNATIONAL AIRLINES

	Passenger Revenues 1955	Passenger Revenues 1954	Freight Revenues 1955	Freight Revenues 1954	Express Revenues 1955	Express Revenues 1954	U. S. Mail Revenues 1955	U. S. Mail Revenues 1954	Total Operating Revenues 1955	Total Operating Revenues 1954	Total Operating Expenses 1955	Total Operating Expenses 1954	Net Operating Income 1955	Net Operating Income 1954
American	$ 4,472,333	$ 3,635,237	$ 535,871	$ 447,488	$ 1,554	$ 1,689	$ 50,501	$ 74,343	$ 5,365,683	$ 4,424,137	$ 4,471,643	$ 4,591,587	$ 894,040	$ —167,450
Braniff	5,666,482	6,011,115	399,499	442,942	.....	.....	242,925	2,669,563	7,263,294	9,628,556	7,761,511	7,828,968	—498,217	1,799,588
Colonial	1,566,843	2,049,211	19,176	20,809	.....	.....	8,354	59,976	1,720,141	2,218,867	1,660,617	2,117,930	59,524	100,937
Delta	4,045,885	3,593,744	207,185	285,587	.....	.....	49,742	76,413	4,455,229	4,117,142	4,807,518	5,272,825	—352,289	—1,155,683
Eastern	9,519,127	8,068,776	207,745	209,406	.....	.....	295,206	428,178	10,710,406	9,557,647	8,737,312	8,789,301	1,973,094	768,346
National	3,569,357	3,239,910	131,027	122,325	15,880	13,225	39,592	23,641	3,899,541	3,507,307	3,902,419	3,704,688	—2,878	—197,381
Northwest	12,697,675	10,686,141	2,594,605	2,479,963	59,193	53,425	4,937,556	4,912,900	21,357,267	18,990,025	21,600,818	17,584,163	—243,551	1,405,862
Panagra	14,108,687	13,243,453	1,130,436	1,109,309	.....	.....	306,771	2,501,721	17,979,301	18,717,057	17,071,532	17,137,913	907,769	1,579,144
Pan American														
Latin Amer.	55,300,000	49,348,702	9,423,000	9,212,566	.....	.....	1,821,000	13,171,346	(1)	76,652,660	(2)	69,629,723	(3)	7,022,937
Atlantic	77,467,000	59,015,010	7,174,000	5,518,130	.....	.....	5,943,000	12,266,400	(1)	83,052,351	(2)	76,519,556	(3)	6,532,795
Pacific	42,800,000	32,781,084	5,260,000	4,081,103	.....	.....	6,656,000	11,833,642	(1)	52,025,948	(2)	46,224,763	(3)	5,801,185
Alaska	4,161,000	4,004,191	897,000	1,058,280	.....	.....	193,000	1,569,500	(1)	6,946,252	(2)	6,914,325	(3)	31,927
TWA	47,188,472	45,206,289	3,638,160	3,850,057	.....	.....	4,626,666	4,382,687	60,736,760	58,532,457	59,293,806	53,921,928	1,442,954	4,510,529
United	11,106,820	8,775,391	192,779	176,438	.....	.....	448,940	247,118	11,962,537	9,404,904	9,623,057	8,949,969	2,339,480	454,935
TOTALS	293,669,681	249,658,254	31,810,483	29,014,403	76,627	68,339	25,619,253	54,217,428*	382,967,159	357,675,310	364,310,233	329,187,639	18,656,926	28,487,671

LOCAL SERVICE AIRLINES

	Passenger Revenues 1955	Passenger Revenues 1954	Freight Revenues 1955	Freight Revenues 1954	Express Revenues 1955	Express Revenues 1954	Mail Revenues 1955	Mail Revenues 1954	Total Operating Revenues 1955	Total Operating Revenues 1954	Total Operating Expenses 1955	Total Operating Expenses 1954	Net Operating Income 1955	Net Operating Income 1954
Allegheny	$ 3,646,297	$ 2,762,383	.....	.....	$ 110,088	$ 75,621	$ 95,129	$ 1,873,194	$ 5,551,508	$ 4,797,854	$ 5,748,249	$ 4,763,220	$ —196,741	$ 34,634
Bonanza	1,356,670	1,026,589	$ 28,952	$ 20,260	15,516	8,597	38,329	881,153	2,400,878	1,956,280	2,427,400	1,879,802	—26,522	76,478
Central	875,515	482,102	33,024	22,701	11,020	10,531	77,223	1,797,085	3,144,371	2,327,793	3,049,659	2,284,153	94,712	43,640
Frontier	2,506,938	2,084,138	211,339	154,019	36,029	32,565	119,944	2,821,733	5,522,749	5,179,667	5,469,394	5,025,927	53,355	153,740
Lake Central	1,048,610	679,762	.....	.....	70,666	50,476	69,197	1,546,469	2,598,046	2,301,491	2,585,434	2,244,854	12,612	56,637
Mohawk	3,391,387	2,663,029	55,020	50,101	33,493	28,949	43,392	859,031	4,307,476	3,683,128	4,318,126	3,498,545	—10,650	184,583
N. Central	4,901,381	3,346,663	.....	.....	126,476	75,630	187,704	2,328,920	6,790,079	5,828,804	6,598,980	5,657,260	191,099	171,544
Ozark	2,271,816	1,466,747	.....	.....	68,069	38,963	96,719	1,772,026	4,300,198	3,354,771	4,360,369	3,311,939	—60,171	42,832
Piedmont	4,333,828	3,870,215	76,937	68,996	53,285	46,368	88,732	2,209,544	6,406,532	6,308,412	6,397,708	6,109,620	8,824	198,792
Southern	1,660,644	1,319,842	.....	.....	56,478	37,046	106,860	1,935,733	3,567,291	3,362,638	3,471,414	3,226,047	95,877	136,791
Southwest**	2,781,027	2,006,971	51,350	35,097	33,799	27,013	74,259	1,129,952	4,227,688	3,455,519	4,067,493	3,185,691	160,195	269,828
Trans-Texas	2,106,091	1,761,828	62,701	55,634	33,164	29,406	139,101	2,737,067	4,866,352	4,628,455	4,616,206	4,530,470	250,146	97,985
West Coast	1,940,122	1,640,204	35,593	23,893	15,552	14,375	48,207	1,523,595	3,538,190	3,228,214	3,739,209	3,343,496	—201,019	—115,282
TOTALS	32,820,326	†28,382,785	554,916	†511,109	663,635	†510,108	1,184,796	†25,288,454*	57,221,358	†55,845,278	56,849,641	†54,244,763	371,717	†1,600,515
HELICOPTER MAIL SERVICE														
HAS	.....	.....	.....	.....	.....	.....	73,420	501,802	513,709	533,489	461,176	476,740	52,533	56,749
Los Angeles	29,153	1,145	.....	.....	70,982	33,632	137,050	946,055	1,092,399	985,525	934,521	772,464	157,878	213,061
N. Y. Airways	179,684	62,056	23,277	16,422	29,023	2,326	40,274	1,430,359	1,749,792	1,552,166	1,559,996	1,382,867	189,796	169,299

** 1954 mail revenue column includes mail pay and subsidy; 1955 column shows mail pay only; the two columns, therefore are not comparable.*

*** Preliminary figures shown for Southwest Airways.*

† 1954 local service totals include Braniff's operations of local service route 106 and Pioneer Air Lines' figures. Effective April 1, 1955, Braniff's local service operations were included in the company's domestic report; Pioneer Air Lines merged with Continental Air Lines effective April 1, 1955.

(1) Pan American Airways' lists total operating revenues for all four divisions combined, $237,517,000.

(2) Pan American Airways lists total operating expenses for all four divisions combined, $225,380,000.

(3) Pan American Airways lists net operating income for all four divisions combined, $12,137,000.

Worldwide Directory of Airlines

North American

United States

AAXICO (American Air Export & Import Co.), Int'l Airport, P. O. Box 875, Miami 48, Fla.

Aerovias Sud Americana, Inc. (ASA International Airlines), Pinellas Int'l Airport, St. Petersburg, Fla.

Allegheny Airlines, Inc., Washington National Airport, Hangar No. 12, Washington 1, D. C.

American Airlines, Inc., Executive offices, 100 Park Ave., New York 17, N. Y.; Operations offices LaGuardia Airport Station, Flushing 71, N. Y.

Bonanza Air Lines, Inc., P. O. Box 391, McCarran Field, Las Vegas, Nev.

Braniff Airways, Inc., Love Field, Dallas 19, Tex.

Capital Airlines, Inc., Washington National Airport, Washington 1, D. C.

Caribbean-Atlantic Airlines, Inc., P. O. Box 6035, Loiza Station, Santurce, P.R.

Central Airlines, Inc., Meacham Field, Ft. Worth, Tex.

Colonial Airlines, Inc., Executive offices 230 Park Ave., New York 17, N. Y.

Continental Air Lines, Inc., Stapleton Airfield, Denver 7, Colo.

Delta Air Lines, Inc., Atlanta Airport, Atlanta, Ga.

Eastern Air Lines, Inc., Eastern Air Lines Bldg., 10 Rockefeller Plaza, New York 20, N. Y.

The Flying Tiger Line, Inc., Lockheed Air Terminal, Burbank, Calif.

Frontier Airlines, Inc., Stapleton Airfield, Denver 5, Colo.

Hawaiian Airlines Ltd., Honolulu Int'l Airport, P. O. Box 3287, Honolulu 1, Hawaii

Helicopter Air Service, Inc., 5036 W. 63rd St. Chicago 38, Ill.

Lake Central Airlines, Inc., Weir Cook Municipal Airport, Indianapolis 44, Ind.

Mackey Airlines, Inc., Executive offices, Broward County Int'l Airport, Fort Lauderdale, Fla.

Midet Aviation Corp., Palm Beach Int'l Airport, West Palm Beach, Fla.

Mohawk Airlines, Inc., Cornell University Airport, Ithaca, N. Y.

National Airlines, Inc., Aviation Building, 3240 N. W. 27th Ave., Miami 42, Fla.

New York Airways, Inc., LaGuardia Airport Station, Flushing 71, N. Y.

North Central Airlines, Inc., 6201 34th Ave. South, Minneapolis 23, Minn.

Northeast Airlines, Inc., Logan Int'l Airport, 239 Prescott St., E. Boston 28, Mass.

Northwest Airlines, Inc., 1885 University Ave., St. Paul 1, Minn.

Ozark Air Lines, Inc., Box 7, Lambert Field, St. Louis 21, Mo.

Pan American World Airways, Inc., 135 East 42nd St., New York 17, N. Y.; Atlantic Div., 28-19 Bridge Plaza, North Long Island City 1, N. Y.; Latin American Div. Miami Int'l Airport, Miami, Fla.; Pacific-Alaska Div., Int'l Airport, San Francisco, Calif.

Pan American-Grace Airways, Inc., 135 East 42nd St., New York 17, N. Y.

Piedmont Airlines, Smith Reynolds Airport, Winston-Salem, N. C.

Resort Airlines, Inc., 1346 Connecticut Ave., N. W., Washington 6, D. C.

Riddle Airlines, Inc., Int'l Airport, P. O. Box 535, Miami 48, Fla.

Seaboard & Western Airlines, Inc., 80 Broad St., New York 4, N. Y.

Slick Airways, Inc., 3000 N. Clybourn Ave., Burbank, Calif.

Southern Airways, Inc., Executive offices Brown-Marx Bldg., Birmingham, Ala.; traffic, sales & operations Atlanta Airport, Atlanta, Ga.

Southwest Airways Co., San Francisco Int'l Airport, San Francisco, Calif.

Trans World Airlines, Inc., Executive & sales offices 380 Madison Ave., New York 17, N. Y.; operations 10 Richards Road, Kansas City 5, Mo.

Trans-Pacific Airlines, Ltd. (The Aloha Airline), P. O. Box 3769, Honolulu, T. H.

Trans-Texas Airways, Municipal Airport, Houston, Tex.

United Air Lines, Inc., Executive offices 5959 S. Cicero Ave., Chicago 38, Ill.; operating base Stapleton Field, Denver, Colo.

Uraba, Medellin & Central Airways, Inc., 135 E. 42nd St., New York, N. Y.

West Coast Airlines, Inc., Boeing Field, Seattle 8, Wash.

Western Air Lines, Inc., 6060 Avion Drive, P. O. Box 45,005, Airport Station, Los Angeles 45, Calif.

(*Continued on page 156*)

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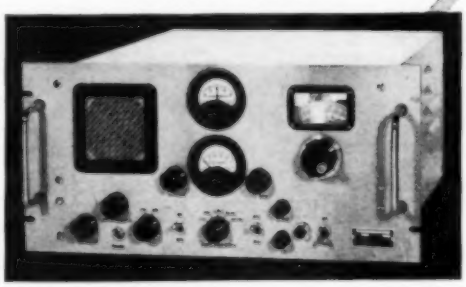

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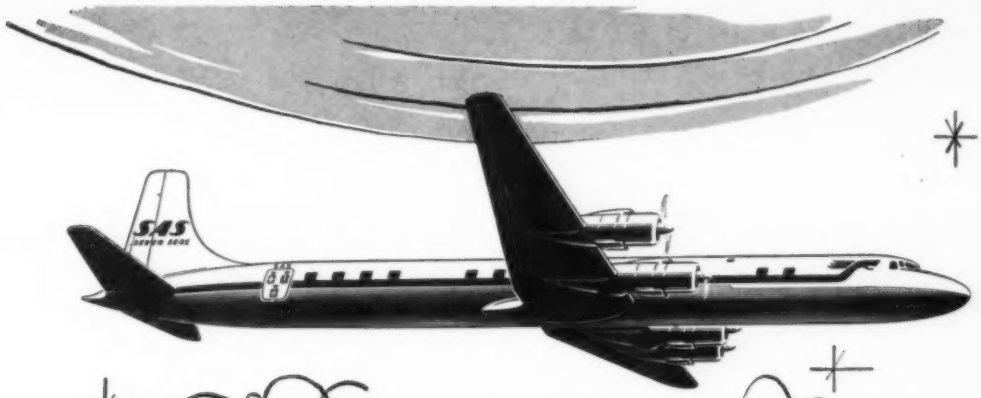

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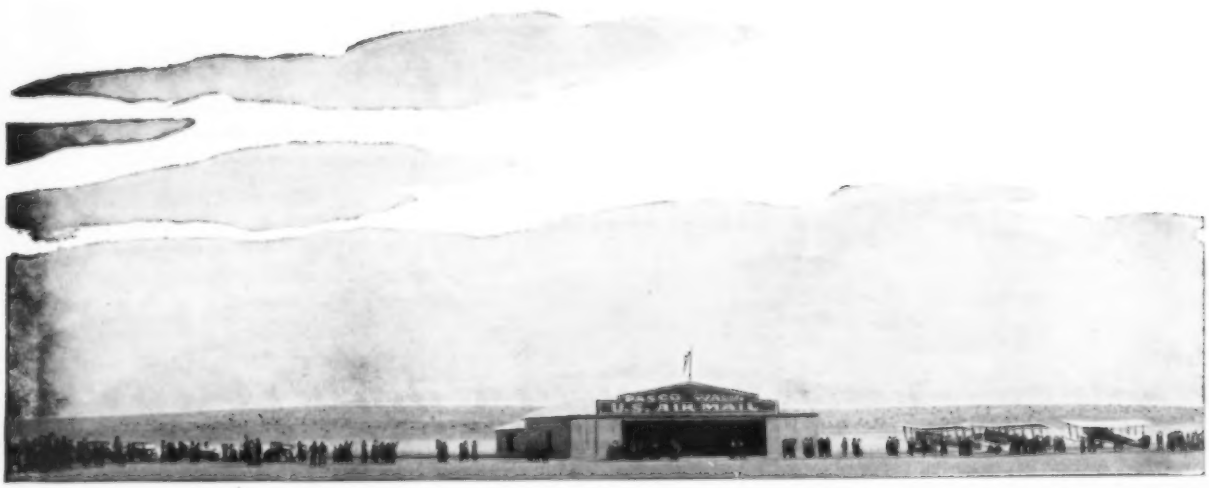

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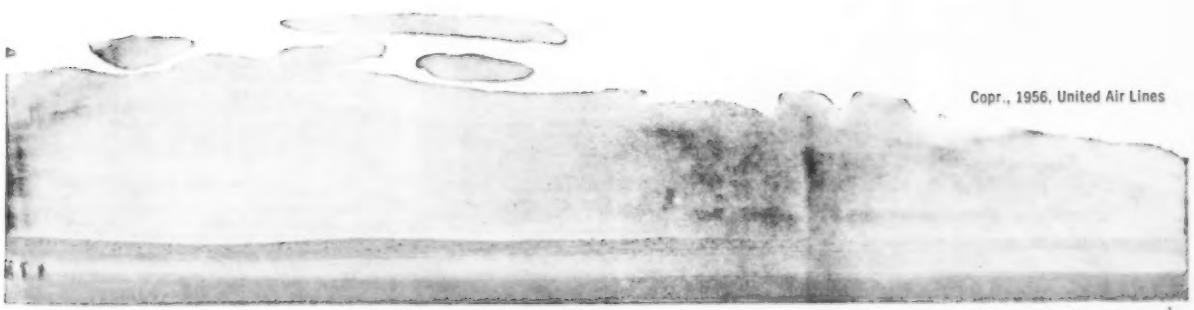

Copr., 1956, United Air Lines

(Continued from Page 152)

Alaska

Alaska Airlines, Inc., General offices 2320 Sixth Ave., Seattle, Wash.
Alaska Coastal Airlines, 2 Marine Way, Juneau, Alaska
Byers Airways, Inc., Box 1410, Fairbanks, Alaska
Christensen Air Service, Anchorage, Alaska
Cordova Airlines, P. O. Box 1499, Anchorage, Alaska
Ellis Air Lines, Box 1059, Ketchikan, Alaska
Northern Consolidated Airlines, Inc., 414 Fourth Ave., Anchorage, Alaska
Pacific Northern Airlines, Inc., Anchorage, Alaska (Mail: 1626 Exchange Bldg., Seattle 4, Wash.)
Reeve Aleutian Airways, Inc., 420 D. St., Box 559, Anchorage, Alaska
Safeway Airways, Merrill Field, Anchorage, Alaska
Wien Alaska Airlines, Inc., Box 649, Fairbanks, Alaska

Canada

Air Ambulance Service, Regina, Saskatchewan
B.N.P. Airways, Ltd., Vancouver Airport, B. C.
Canadian Pacific Airlines, Ltd., head office Vancouver Airport, B. C.
Central Northern Airways, Ltd., head office Stevenson Airport, Winnipeg
Laurentian Air Services, Ltd., P. O. Box 71, Ottawa, Ont.
Laurentide Aviation Ltd., Cartierville Airport, Montreal 9, Que.
Leavens Bros. Ltd., head office, Barker Airport, Toronto, Ont.
Maritime Central Airways, Charlottetown, P. E. Island
Northern Wings Ltd., Room 401, 130 St. Jean St., Que., P. Q.
Okanagan Helicopters Ltd., Vancouver Airport, B. C.
Pacific Western Airlines Ltd., Vancouver Airport, B. C.
Quebecair Inc., Rimouski, P. Q.
Saskatchewan Government Airways, P. O. Box 850, Prince Albert, Sask.
Trans-Canada Air Lines, executive offices International Aviation Bldg., 1080 University St., Montreal, P. Q.
Wheeler Air Lines, Ltd.

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Europe

Azores

Sociedade Acoriana de Transportes Aereos (SATA), Rua des Mercadores 7-11, Ponta Delgada

Belgium

Sobelair (Societe Belge de Transports Par Air, S.A.), 137, Rue Royale, Brussels
Sabena Belgian World Airlines (Societe Anonyme Belge D'Exploitation de la Navigation Aerienne), Air Terminus, Brussels

Bulgaria

Transport Aerien Civil Bulgare (Tabso), 12 Place Narodno, Sabranie, Sofia

Czechoslovakia

Ceskoslovenske Aerolinie (Czechoslovak Airlines), 1 Namesti Republiky, Prague

Denmark

Det Danske Luftfartselskab A/S (DDL) (Danish Air Lines), Copenhagen Airport, Kastrup

Finland

Aero O/Y (Finnair), Mannerheimintie 9B, P. O. Box 278, Helsinki
Karhumaki Airways, Lonnrotinkatu 3, Helsinki

France

Compagnie Nationale Air France, 2, rue Marbeuf, Paris 8°
Compagnie de Transports Aeriens Intercontinentaux (TAI), 23, rue de la Paix, Paris 2°
Union Aeromaritime de Transport (UAT), 5, Boulevard Malesherbes, Paris 8°

Germany

Deutsche Lufthansa (Lufthansa), Claudiusstrasbe 1, Koln
Deutsche Lufttransport Gesellschaft m.b.H., Fuhlsbuttel Airport, Hamburg

Gibraltar

Gibraltar Airways Ltd. (Gibair), Cloister Bldg., Box 212, Irish Town

Great Britain

Air Charter, Ltd., 15 Great Cumberland Pl., London, W. I.
Air Kruise (Kent) Ltd. (Trans Channel Airways), Lydd Airport (Ferryfield), Lydd, Kent
Airwork Ltd., 15 Chesterfield St., London, W. I.
Aquila Airways Ltd., 1 Great Cumberland Pl., London, W. I.
B.K.S. Air Transport, Ltd., 1 Marylebone High St., London, W. I.
British European Airways Corp., head office, Keyline House, South Ruislip, Middlesex
British Overseas Airways Corp., (BOAC), BOAC Headquarters, London Airport, Hounslow, Middlesex
Cambrian Air Services, Ltd., Cardiff (Rhoose) Airport, Cardiff, Glam., South Wales
Derby Aviation Ltd., Derby Airport, Burnaston, Derby
Dragon Airways, Ltd., Liverpool Airport, Liverpool
Eagle Aviation Ltd., 29 Clarges St., London, W. I.
East Anglian Flying Services, Ltd., Airport, Southend-on-Sea, Essex
Don Everall (Aviation) Ltd., Birmingham Airport, Birmingham
Hunting-Clan Air Transport, Ltd., 72 Wigmore St., London, W. I.
Jersey Airlines, 4 The Parade, Jersey Channel Islands
Lancashire Aircraft Corp., Ltd., 7 Berkeley St., London, W. I.
Manx Airlines, Ltd., Ronaldsway Airport, Isle of Man
Morton Air Services Ltd., Croydon Airport, Surrey
Olley Air Service, Ltd., Main Hall, Croydon Airport, Surrey
Scottish Airlines (Prestwick) Ltd., Prestwick Airport, Ayrshire, Scotland
Silver City Airways, Ltd., 1 Great Cumberland Pl., London, W. I.
Transair, Ltd., Croydon Airport, Surrey

Greece

TAE National Greek Airlines, 12 Merlin St., Athens

Hungary

Malev (Hungarian Air Transport), 5 Vorosmarty-ter, Budapest

Iceland

Flugfelag Islands, H. F. (Iceland Airways, Ltd.), Laekjargata 4, Reykjavik

Ireland

Aer Lingus TTA (ALT), 43 Upper O'Connell St., Dublin
Aer Rianta TTA (ART), 43 Upper O'Connell St., Dublin

Italy

Aerolinee Italiane Internazionali (Alitalia), via Leonida Bissolati, 20, Rome
LAI—Linee Aeree Italiane (Italian Airlines), Via del Tritone, 132, Rome

Malta

The Malta Airlines, 285 Kingsway, Valletta

Netherlands

KLM Royal Dutch Airlines (Koninklijke Luchtvaart Maatschappij N. V.), Piesmanweg 1, P. O. Box 121, The Hague

Norway

Braathens South-American & Far East Airtransport A/S (S.A.F.E.), Fr. Nansens plass 7, Oslo
Det Norske Luftfartselskap A/S (DNL) (Norwegian Air Lines), Fornebu Airport, Oslo
Fred. Olsen Airtransport Ltd., Fred. Olsens gate 2, Oslo
Vestlandske Luftfartselskap A/S (West Norway Airlines), Trafikkontor Airport, Bergen
Wideroe's Flyveselskap OG Polarfly A/S, Kr. Augustsgat 19, Oslo

Poland

Polskie Linie Lotnicze (LOT), Lot Building, rue Hoza 39, Warsaw

Portugal

TAP—Transportes Aereos Portugueses, S.A.R.L., 2 Rua Braamcamp, Lisbon

Romania

Transporturi Aeriene Romine (Tarom), Baneasa Airport, Bucharest

Spain

Aviacion y Comercio S. A., 33 Calle Aduana, Madrid
Iberia (Lineas Aereas Espanolas), Avenida de America No. 2, Madrid

Sweden

Aero-Nord Sweden AB, Bromma Airport, Stockholm 40
Airtaco AB, Bromma Airport, Stockholm 40
Aktiebolaget Aerotransport (ABA) (Swedish Air Lines), Bromma Airport, Stockholm 40
AB Malmo Flygindustri, Bulltofta Airport, Malmo 12
Foreningen Ostgotaflyg, c/o Linkopings Flygklubb, Linkoping
AB Nordisk Aerotjanst (Nordaero), Kungsangens Flygplats, Norrkoping
Ostermans Aero AB, Stockholm 7
Scandinavian Airlines System (Denmark, Norway and Sweden), head office Bromma Airport, Stockholm 40
Svensk Flygtjanst A.B. (Swedish Air Service Ltd.), Arsenalsgatan 4, Stockholm
Svenska Aero, Vestlung & Co., Bromma Airport, Stockholm 40

Switzerland

Swissair (Swiss Air Transport Co., Ltd.), Hirschengraben 84, P. O. Box 929, Zurich

U.S.S.R.

Aeroflot (Russian Air Lines), Hotel Metropol, Place Sverdlova, Moscow

Yugoslavia

Jugoslovenski Aerotransport (JAT), Birceninova 1/111, Belgrade

Central & South America

Argentina

Aerolineas Argentinas, Paseo Colon 185, Buenos Aires
Compania de Aviacion Pan American Argentina, Av. Pte. Roque Saenz, Pena 788, Buenos Aires
Lineas Aereas del Estado (LADE), Corrientes 480, Buenos Aires

Bahama Islands

Bahamas Airways, Ltd. (BAL), Oakes Airfield, Nassau

Bolivia

Lloyd Aereo Boliviano S.A. (LAB), Casilla 132, Cochabamba

Brazil

Consorcio REAL-Aerovias, Rua Conselheior, Crispiniano, 379-2° andar, Sao Paulo
Empresa de Transportes Aereos Norte do Brazil S.A. (Aeronorte), Rua Oswaldo Cruz, 341, Sao Luiz, Maranhao
Empreso de Transportes Aereos Catarinense, S.A. (TAC), Felipe Schmidt 14, Florianopolis, Santa Catarina
Loide Aereo Nacional S/A (Loide), Av. 13 de Maio, 13-27° andar, Rio de Janeiro
Nacional Transportes Aereos S.A., Av. Franklin Roosevelt 137, 12° and., Rio de Janeiro
Panair do Brasil, S.A., Edificio Panair, Aeroporto Santos-Dumont, Caixa Postal 694, Rio de Janeiro
REAL-Aerovias Brasil (Brazilian International Airlines) (BIA), Rua Conselheiro, Crispiniano 379, Sao Paulo
S. A. Empresa de Viacao Aerea Rio Grandense (Varig), Av. Borges de Medeiros 410-16° and P. O. Box 243, Porto Alegre, RGS
S. A. Viacao Aerea Gaucha (SAVAG), Edificio Camara do Comercio, Rio Grande do Sul
Servicos Aereos Cruzeiro do Sul, Ltd. (Cruzeiro), Avenido Rio Branco 128, P. O. Box 190, Rio de Janeiro

(Continued on Page 161)

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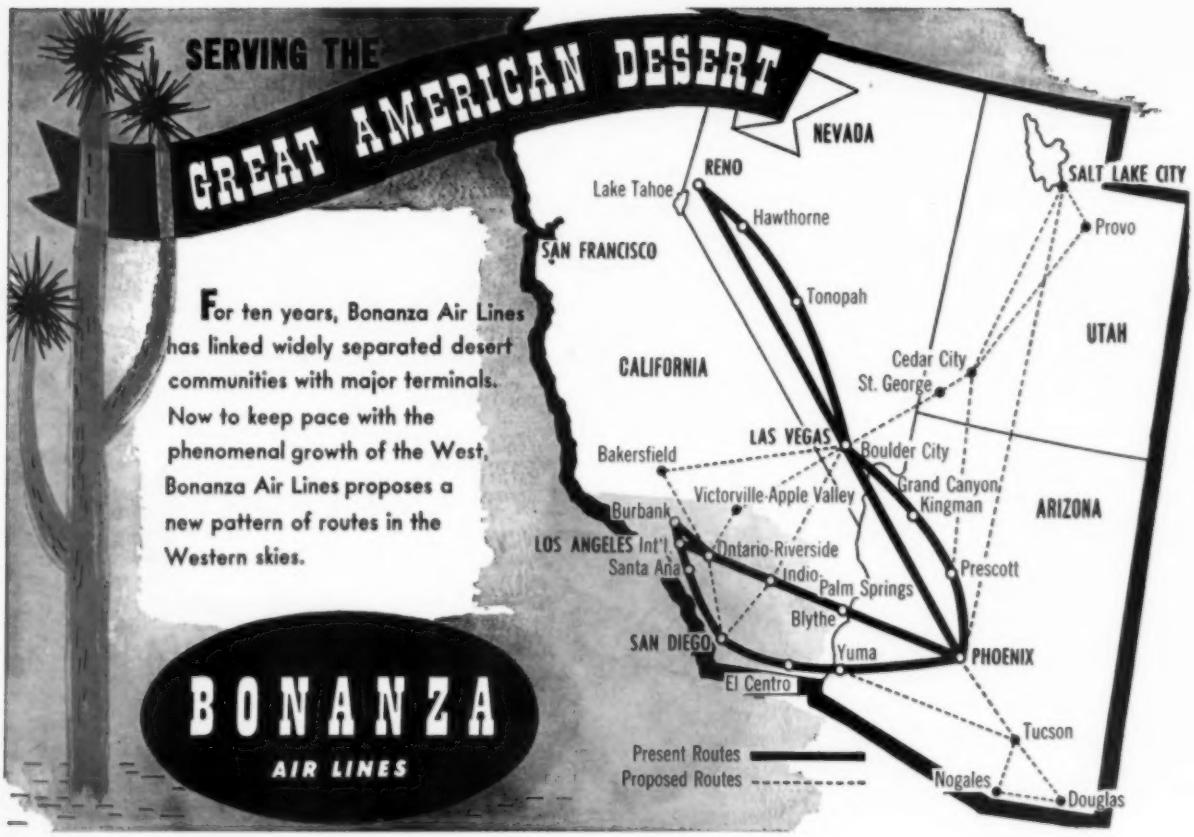

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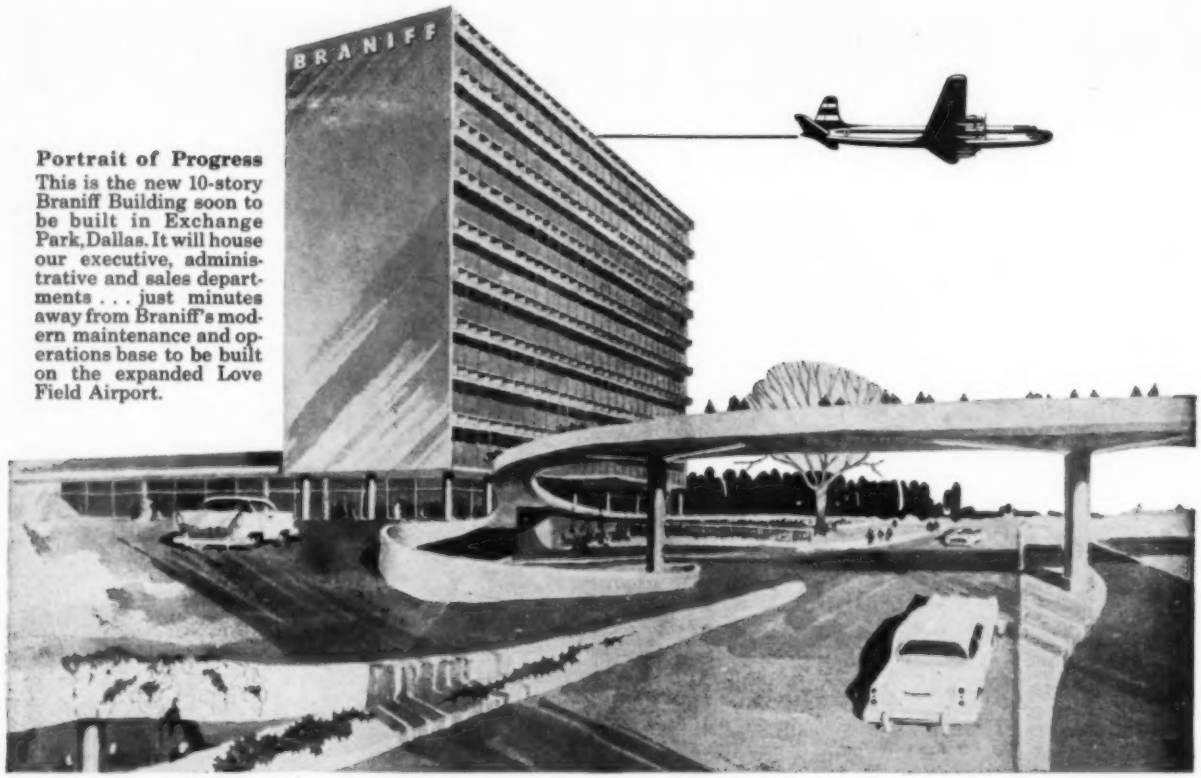

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(Continued from Page 157)

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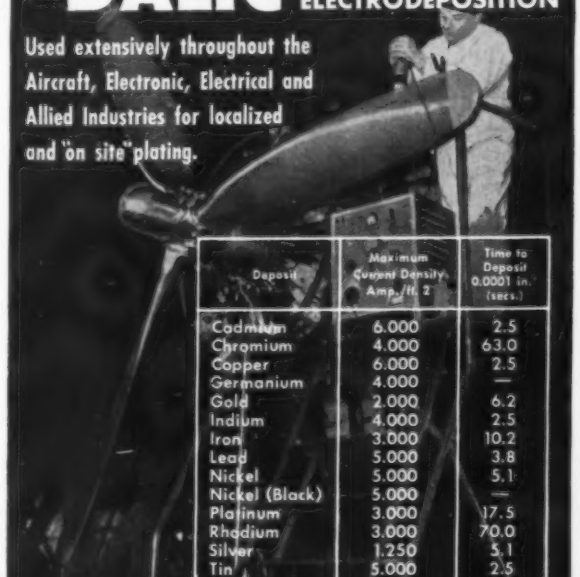

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Iron	3.000	10.2
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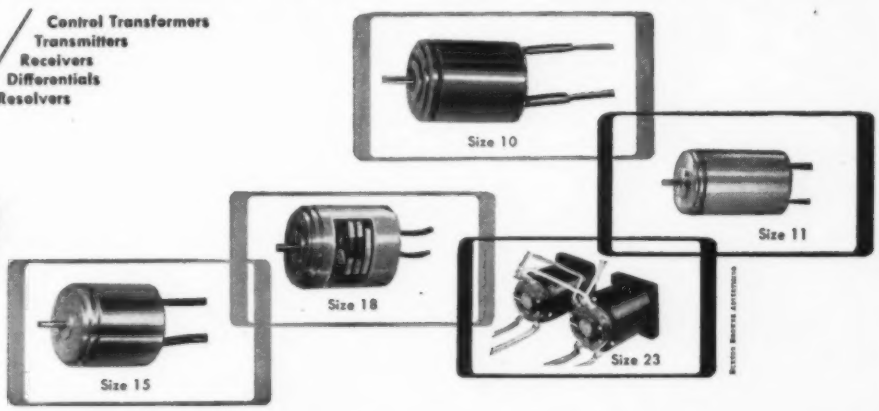

TYPE SYNCHRO	SIZE	OSTER TYPE	Frequency C.P.S.	Input Rotor Volts	Input Rotor Amps	Input Rotor Watts	Output Stator Volts	Input Stator Volts	Input Stator Amps	Input Stator Watts	Output Rotor Volts	Rotor Resistance Ohms	Stator Resistance Line to Line Ohms	Null Voltage	Angular Accuracy Maximum Spread
Control Transformer	10	3G-4055	400	26	0.030	0.30	11.8	11.8	0.060	0.20	21.3	160	45	0.050	30′
Control Transformer	10	3G-4079	400	26	0.008	0.10	11.8	11.8	0.018	0.10	20.3	510	200	0.050	30′
Transmitter	10	3G-4075	400	26	0.180	1.4	11.8	—	—	—	—	25	11	0.070	30′
Receiver	10	3G-4059	400	26	0.180	1.4	11.8	—	—	—	—	25	11	0.070	1½°
Differential	10	3G-4071	400	—	—	—	—	11.8	0.070	0.30	11.8	90	45	0.050	30′
Resolver	10	3G-4063	400	26	0.033	0.40	11.8	11.8	0.050	0.20	18.0	235	42	0.050	30′
Resolver	10	3G-4067	400	26	0.011	0.10	11.8	11.8	0.018	0.10	20.3	450	165	0.050	30′
Control Transformer	11	2C-4105	400	26	0.040	0.030	11.8	11.8	0.085	0.19	22.5	91.5	14.2	0.050	20′
Transmitter	11	2C-4125	400	26	0.150	0.80	11.8	—	—	—	—	20	4.3	0.050	20′
Transmitter	11	2C-4123	400	26	0.230	1.0	11.8	—	—	—	—	10.3	4.0	0.070	20′
Control Transformer	15	2G-4005	400	26	0.065	0.40	11.8	11.8	0.150	0.40	21.4	40	10.2	0.050	15′
Transmitter	15	2G-4025	400	26	0.225	1.25	11.8	—	—	—	—	9.5	3.8	0.070	20′
Receiver	15	2G-4009	400	26	0.10	0.45	11.8	—	—	—	—	16	6.7	0.070	45′
Differential	15	2G-4021	400	—	—	—	—	11.8	0.325	0.9	11.8	—	—	0.040	20′
Differential	15	2G-4041	400	—	—	—	—	11.8	0.120	1.3	11.8	14	10.2	0.050	15′
Resolver	15	2G-4017	400	26	0.014	—	18.0	18.0	0.015	—	21	239	180	0.050	40′
Transmitter 12 Power	18	3H-3309	400	26	0.77	2.3	11.8	—	—	—	—	1.032	0.675	0.050	20′
Differential	18	3H-3301	60	—	—	—	—	90	0.070	2.0	90	730	385	0.125	24′
Transmitter	23	3J-4222	60	115	0.120	3.2	17.0	—	—	—	—	140	8.3	0.050	30′

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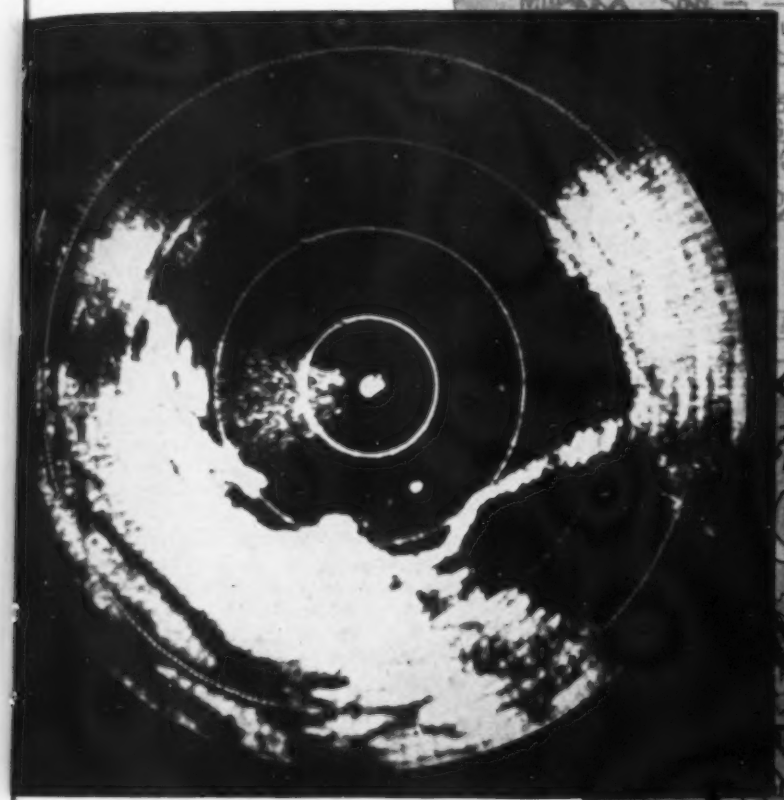

Circled portion of aeronautical chart as seen on scope of AVQ-10 on in-bound airliner (Note Hayward-San Mateo County bridge).

Portion of sectional aeronautical chart looking north on San Francisco Bay area.

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These ground-mapping characteristics are in addition to the recognized superiority of the AVQ-10 as a weather radar. It is the first airborne radar to use the C-band (5.6 cm) transmission, the wavelength best suited to weather detection and avoidance, yet having the least amount of scope clutter. With it, the pilot can evaluate storms up to 150 miles ahead and pick non-turbulent paths between them. In addition to avoiding costly detours, the AVQ-10 contributes materially to passenger comfort.

All this has made the demand for the AVQ-10 great and pressing. Many leading airlines have already specified it. To secure early installation, other airline and executive plane operators are invited to write now for further information.

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Light Twin Dominates Business Flying Picture

Four leading companies marketed 1,235 twins in 1955; backlogs extend production into late summer and early fall.

The light twin-engine transport dominated the business flying world in the past year. Single-engine operators have established a definite trend of changing to the new equipment for greater reliability and utility. And some companies operating the larger airline-type equipment found that the small twin provided less costly transportation with equally acceptable utility.

The four manufacturers building the new executive aircraft types delivered 808 during 1955, nearly triple the 354 put into service in 1954. Together, Cessna, Aero Design, Beech and Piper have completed 1,235 light twins as of the first two months in 1956 since they were first marketed just a little over two years ago.

Beech, Cessna and Piper—"The Big Three" of the single-engine industry—have found that their twin designs already account for an average of one-third of their total sales. The picture by company shows:

• **Piper rolled out** its 500th Apache early in March and expects to run the total up to about 1,000 by the end of 1956. Production on June 1 will be stepped up to 10 Apaches a week from the present eight-a-week to meet demands.

• **Beech has passed** the 300 mark on its Twin Bonanza. An additional 150 of the high performance executive aircraft will be delivered during the current year on a production schedule of 6/10ths of a plane per day.

• **Cessna's fast Model 310 twin** is coming off the production line at the rate of one a day. The Wichita firm has delivered 240 to date and will deliver an additional 250 by the end of the year.

• **Aero Design & Engineering Co.**, which marketed the first twin in August, 1951, has delivered more than 275 of its Aero Commander series to date. Before phasing out the original Model 520, 120 had been put in service. The later Model 560 scored 80 deliveries before giving way to the two current models being produced side-by-side.

With a 1956 production estimate of 160 Aero Commanders, the company as of the earlier part of the year had manufactured 69 of its Model 560As and had completed six of its supercharged Model 680 which first came off the line in late March.

All four companies have backlogs for the small twins that extend into the late summer and early fall. The future of the new form of business aircraft is felt to be unlimited. Customers have their choice of the four models at prices ranging from $35,000 to $90,000 and top speeds of over 180 mph for the low-cost Apache to as high as 260 mph for the supercharged Model 680 Aero Commander.

While the Small Twin was settling down to take its place as the possible backbone of the industry, the single-engine aircraft continued to find its own place in the scheme. CAA reported 16,480 single engine airplanes in business use in 1954 (the latest surveyed year) and the manufacturers added 3,626 new aircraft to the total in 1955.

Tri-Cycle Gear Trend

• **A move toward** tri-cycled gear, all metal single-engine aircraft is also on. Cessna announced the Model 172 and Model 182 for 1956 production, for the first time, with its Land-O-Matic gear providing single-engine models with the tri-cycle configuration. Piper revealed for the first time plans to produce an all-metal lightplane for marketing in 1957. Christened the Comanche, the flight-test model is now under construction and should be completed and ready for flight around June or July. The aerodynamically-clean Beech Bon-

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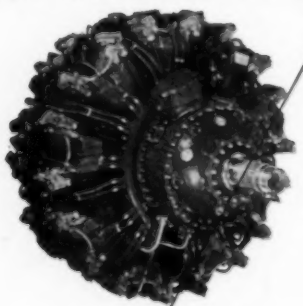

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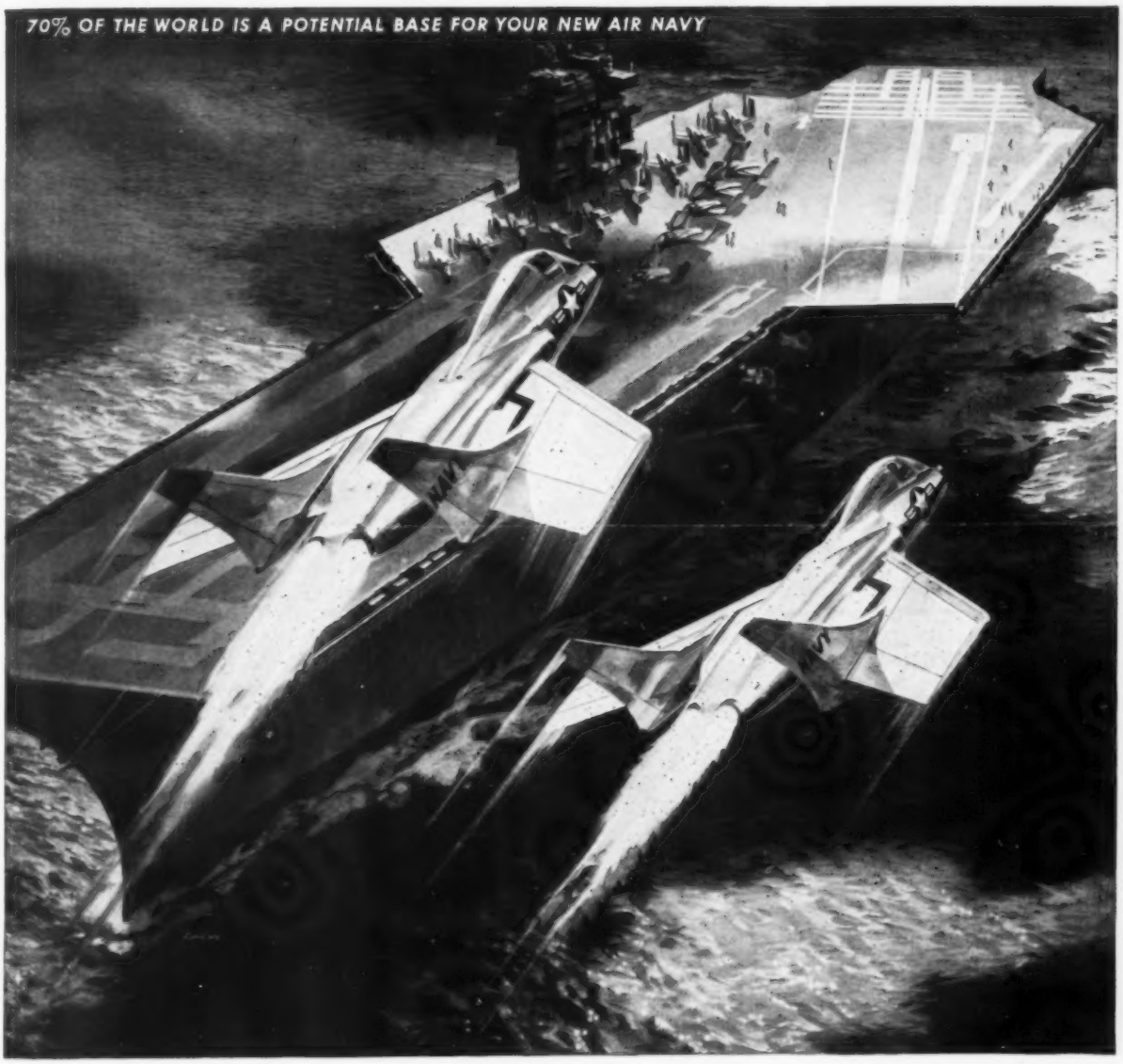

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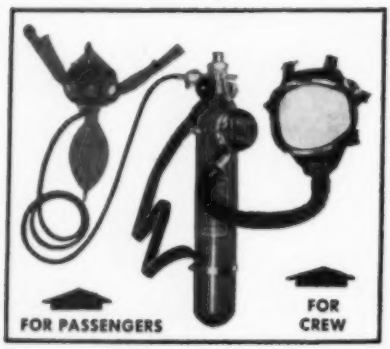

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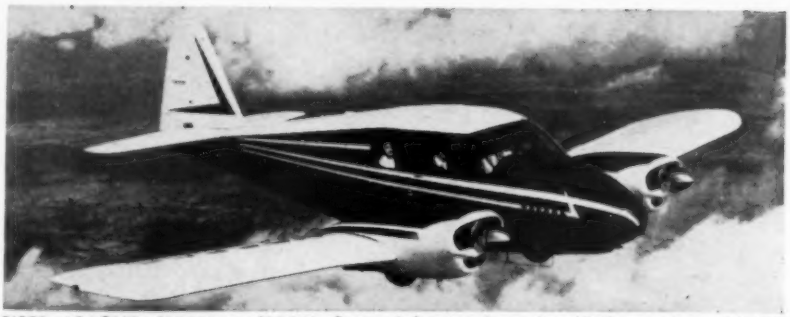
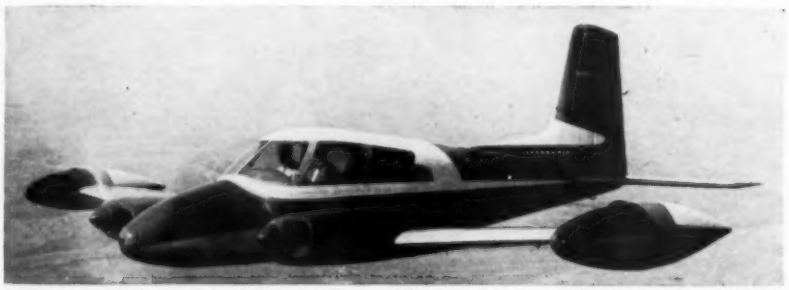
A Twin for Every Pocket . . .



PIPER APACHE—$37,000 to $38,310. Powered by two Lycoming 150-hp. engines with full-feathering Hartzell propellers, it cruises at 170 mph with a range of up to 1,200 miles. Available in four- or five-place versions.



CESSNA MODEL 310—about $50,000. Powered by two Continental 240-hp. engines with full-feathering propellers, it cruises at over 205 mph with a range of over 1,000 miles. Five-place.

BEECH TWIN BONANZA—Standard Model D50, $77,000; Model C50, $75,000. Model D50 is powered by two Lycoming high-compression 295-hp engines with Hartzell three-blade propellers. It cruises at 203 mph, has a range of 1,650 miles. Available with five or six places.

AERO DESIGN AERO COMMANDER—Model 680, $84,500; Model 560A, $74,500-$76,500. Model 680 is powered by two supercharged Lycoming 340-hp engines, cruising at 230 mph with a maximum range of 1,600 miles. Five- to seven-place versions.

anza has been refined to reach speeds of 190 mph at 75% power.

To keep up with the demand, Cessna is on a 15-plane per day production schedule for its Models 170, 172, 180 and 182. Piper is turning out its Tri-Pacer at the rate of 25 a week and Beech will have 5,000 Bonanzas flying by the end of the year, since production started in 1947.

On the other side of the scale of the small twin, the heavier transport types also are in full swing. The Super Twin Beechcraft is on a schedule of a

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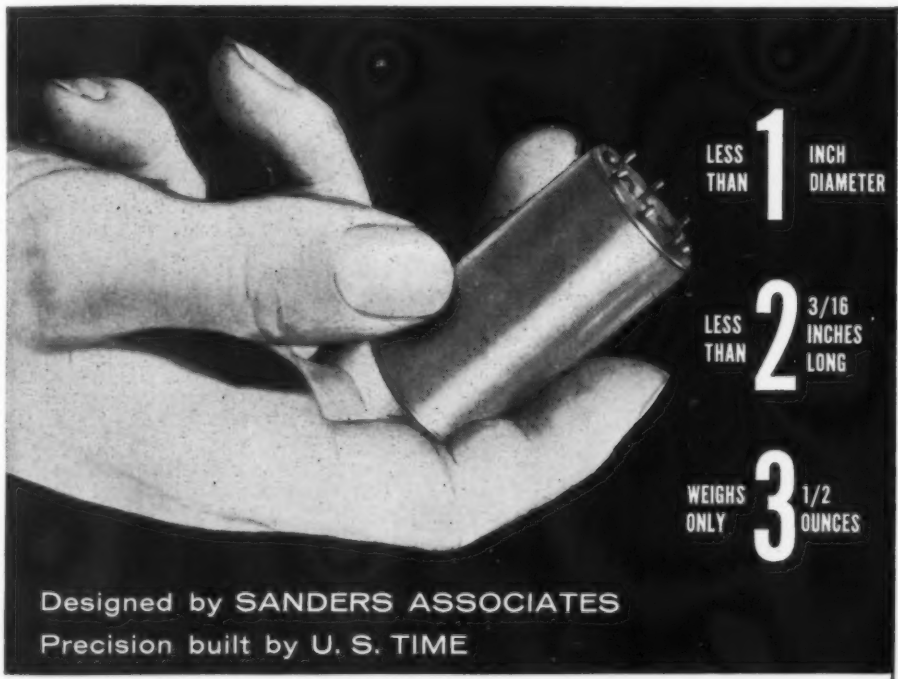
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WEIGHS ONLY 3 1/2 OUNCES
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Precision built by U. S. TIME

- **Flight proven under the most severe environmental conditions.**
- **Readily meets MIL-E-5272A specs.**
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- **Available in max. Rate Ranges from 10°/sec. to 1000°/sec.**

Some of its specifications:

SIZE: 15/16 Dia.x2-3/16 Long

WEIGHT: 3.5 Ounces

MOTOR: 26V, 400CPS, 2ø

RUN UP TIME: 15 Seconds

PICKOFF OUTPUT: 5.6V, 400CPS

RESOLUTION: 0.004°/sec.

AC NULL: 10 to 40 MV

DAMPING: To suit

SHOCK VIBRATION ENVIRONMENTAL: Exceeds applicable MIL-E-5272A specs.

OPER. TEMP. RANGE: −55° to +85° C.

TESTED OPER. LIFE: 1000 hours

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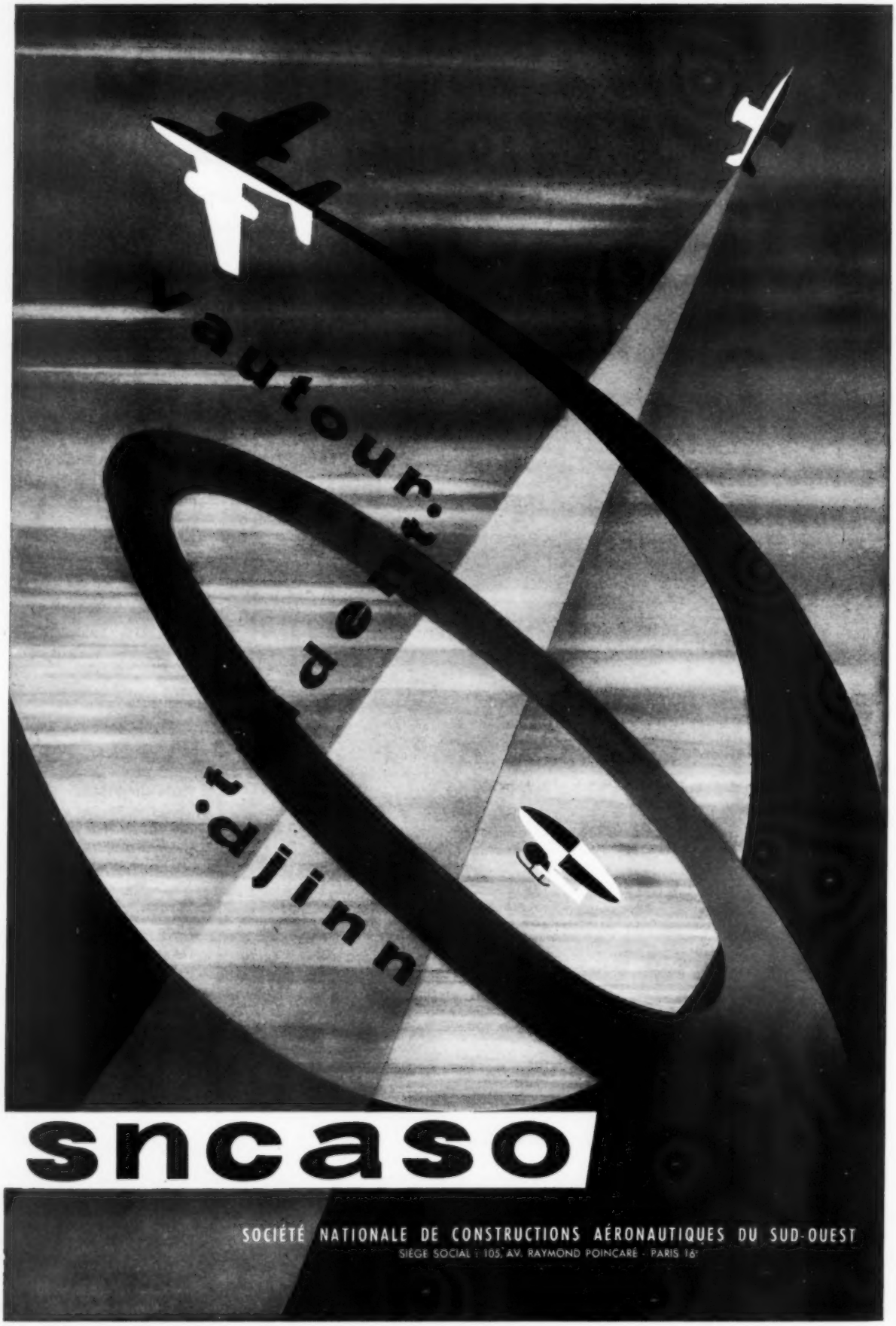
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half a plane a day and 136 of the modernized version old standby D-18s series have been produced. The Learstar, completely re-engineered Lodestar conversion of Lear, Inc., was delivered to 13 customers in 1956 and plans for producing at least 12 more in 1956 were announced. It was significant that the first Convair 440 was delivered, not to an airline, but to a corporate aircraft user.

Looming on the horizon is Cessna's 620 (AMERICAN AVIATION, April 9). Latest word is that a prototype should be completed on the four-engine configuration after May 1, with possible flight in summer. Production plans probably will take shape in 1957 as further sales surveys are completed.

21,000 Planes in Use

With close to 4,500 new business aircraft reaching the market in 1955, the U.S. business fleet now approximates more than 21,000 single- and multi-engine aircraft. Based on new production schedules, this can conceivably reach at least 24,000 planes by the end of 1956.

The AMERICAN AVIATION estimate is based on CAA's 1954 survey, which pegged the fleet at 18,570, of which 16,480 were single-engine, 2,080 multi-engine and 10 helicopters.

With the fleet swelling to a possible 18,000 single-engine planes and 6,000 multi-engine, based on 1955 delivery totals and 1956 plans, the number of hours flown could well top the 5,000,000 mark during 1957. CAA reported an estimated 4,300,000 hours flown in 1956, up from 3,875,000 in 1954. If the market remains at the present blossoming level, CAA estimate of 5.7 million hours by 1960 could well be conservative (See chart).

The impact of this steady ascent is being felt in other areas of the industry. Joseph T. Geuting, director of the Aircraft Industries Association Utility Airplane Council, has declared that non-carrier aviation is potentially the largest user of electronic equipment. It is interesting to note recent trends in this area which tend to confirm this observation:

• **Collins Radio,** one of the largest producers of navigation and communication equipment, told AMERICAN AVIATION that in the first five months of its current fiscal year (up to February) $4½ million of its $11 million in commercial sales was to business aircraft. Percentage rate of business aircraft to total commercial sales has been development on a gradually increasing basis. In 1953, it was 15%; in 1954, 20%, and 1955, 25%.

The Collins Omni Receiver and Glide Path has been one of the "best sellers" to the group. In addition, "a large number" (about 250 units) of the Integrated Flight System have been purchased by business operators of the Aero Commander and Twin Bonanza class and up.

• **National Aeronautical Corp.** caters entirely to the executive group and has experienced a 700% increase in sales in seven years, going from $300,000 in 1950 to $1 million level in 1953. An all-time high of $1,650,000 was reached in 1955 and estimated 1956 sales are pegged at $2,500,000. Narco's most important product has been its low-cost Omnigator with transmitter, receiver and localizer.

Electronic manufacturers have been directing attention to producing specialized equipment for the group. Federal Telephone & Radio Company has developed a lightweight autopilot for lightplanes. Narco and Lear both are reportedly working on lightweight weather radar airborne units.

Service Companies Growing

Service companies are fast learning that makeshift facilities mean loss of revenue from a very lucrative source. Business flying centers are springing up all over the country, representing substantial investments of from $400,000 to

COMCO
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for airport vehicles and ground stations!
NOW! 6/12 VOLT
The CONTROLLER mobile unit was specifically designed for airport vehicles requiring two-way communication with control towers and other aeronautical services such as airlines, flying schools, Unicom, C.A.P., etc.
For use in ramp jeeps, electrician's trucks, crash trucks, tow tractors, snow plows, executive cars, police cars and at temporary locations such as construction sites.
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★ FREQUENCY RANGE: 118 to 152 MC. crystal controlled (CR-18/U crystals).
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★ LOW BATTERY DRAIN: total standby 8 amps. at 6 volts, 5 amps. at 12 volts.
★ UNIVERSAL: instantly changeable from 6 to 12 volt operation.
★ COMPACT: under dash or trunk mounting, case 5½" x 11" x 13".
★ LOW COST MAINTENANCE: the CONTROLLER has earned an excellent reputation for trouble-free operation. High quality standard manufacturers parts used and identified for easy replacement at your local supplier.
★ OPTIONAL ITEMS: hand carried case, weatherproof case, AC adapter for mobile unit.
Complete mobile package
Model 278-E-6/12-2
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Write for available territories.
Complete specifications and price list sent on request.
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more than $2 million. The fact that the fixed-base operators have acquired the confidence to make such capital investments further reflects the firm place they are assuming.

In the past year, Skymotive, Inc. at Chicago's O'Hare Field opened a $1-million facility; Atlantic Aviation in Wilmington, Del., christened a $500,000 hangar and terminal; Southwest Airmotive began construction on a $2-million center. One of the first, Norman Larson Co. in Van Nuys, Calif., has been thriving. The Centers provide passenger facilities, office areas, pilot rooms and lounges, as well as hangar, tiedown and service operations all in one compact area.

Despite the healthy economic aspects of business flying, the true picture of the markets being created is impossible to get in focus because of the policies of some companies that use business planes. These companies have wrapped themselves in a cloak of short-sighted secrecy. Fearful of stockholder criticism, too many companies have created an attitude of suspicion about the use of airplanes in business rather than opening up and explaining to stockholders and the public the true value of the plane's use.

It is strongly felt that a more open, approach—clearly explained—would be accepted. With such an approach, the companies would do themselves and the industry a service. Several aircraft manufacturers, attempting market surveys on potential markets for new aircraft, have bucked up against this extreme reluctance to talk about actual operating costs, utilization and other factors important to the design and production of new planes and equipment.

End result has been manufacturer reluctance to enter the new field. When the statistics are offered, operating costs are too often watered and utilization figures padded. A distorted picture emerges with conflicting statistics. There are extreme cases where corporations go as far as refusing to acknowledge the fact that they even own and operate aircraft. Such information is eventually "leaked" out and creates a negative reaction.

Even in light of the near-fear of the individual companies, it has been ascertained by industry that the business plane operators spend close to a half a billion dollars alone on annual operations, excluding new equipment and major procurements.

Survey Shows Pattern

In an AMERICAN AVIATION survey of a select group of companies operating planes, an interesting pattern emerged. The companies replying were all mixed-fleet operators with from seven to 25 aircraft. Annual budgets for operation, maintenance and personnel ranged from $400,000 for smallest fleet reporting to $900,000 for the largest. The companies reporting represented 65 aircraft ranging from single-engine to Convair equipment, flying about 128,000 hours a year.

• **Aviation personnel salaries** and expenses accounted for 27% to 40% of the total annual budgets. Second highest allocation is for avgas and oil, which account for 14% to 17% of total annual expenditures. Maintenance and repair (excluding modification and conversions) ran an average of 10%, as did depreciation on equipment. Insurance and hangar/storage expenditures average out to 5% for each category.

While one company reported that new accessories and aids were included in its annual budget, another was able to secure special appropriations for such investments. Purchase of new airplanes invariably is exclusive of the special budget.

One owner spent about $88,000 on replacement parts during 1955, while another revealed that a spare parts inventory of $120,000 is maintained at all times. ◆◆◆

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IF YOU ARE PLANNING A NEW AIRPLANE—

TURBOPROP, TURBOJET OR STRAIGHT JET...

Here you see the Hobart Model 871 supplying auxiliary power to the T.C.A. Viscount. The governed speed is 2000 rpm for maximum power for starting the Viscount engines.

The 871, delivered to you ready-to-use, is a compact self-contained power unit and tug combined that can be moved under its own power easily and quickly from one ramp location to another.

Among the many positive things about the 871 that will interest you are:

- Rugged, yet mobile, it was designed with actual aircraft ground power requirements in mind.
- It was engineered for around-the-clock service for maximum efficiency, operating convenience and economy, with minimum maintenance and down-time.
- Powered by the Chrysler Industrial V-8 Engine, the load capacities are up to 1500 amperes for intermittent service.
- Lightweight, short turning radius, greater stability and low silhouette are special features of the 871.
- Functional features include easy steering, full visibility, driver comfort, convenient controls, and hydraulic brakes for smoother stops and greater safety on ramps.
- Overload, overvoltage, overspeed and reverse-current protection, plus regulated voltage with line-drop compensation for constant voltage at the output plug or operational features.
- Economical to operate, simple to handle, and easier to service means less time in the shop, more time on the job.

You will save time by contacting us for information about up-to-date aircraft ground auxiliary power equipment. Call, wire or write today and tell us your needs. There'll be no obligation, of course!

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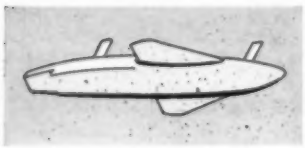
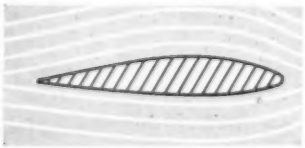
Yes even ice- and snow-covered areas can be utilized as landing fields for aircraft designed to include the Pantobase landing system. A product of Stroukoff research and development, Pantobase will permit landings and take-offs from snow, ice, sand, water and unimproved terrain, thereby extending the operational capabilities of the aircraft and reducing the need for conventional airports in many remote and previously inaccessible parts of the earth's surface.



Pantobase—When designed into an aircraft the Pantobase system enables the plane to land and take-off from many types of surface without changes of additional landing equipment.



BLC-Boundary layer control as developed by Stroukoff increases the effective lift and delays stalling of the wing, thereby reducing required speeds and distances for take-offs and landings.

Achievement is a tradition at Stroukoff. A leader in the development and design of cargo and transport aircraft, Stroukoff offers challenging opportunities to creative engineers.

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WEST TRENTON, NEW JERSEY

Air Traffic Controllers Form New Association

A nucleus of six 15-year veteran CAA traffic controllers at Washington National Airport's control tower have completed the spadework for a new professional society they feel will give the nation's ATC "brains" a much-needed voice in aviation.

The new group, called the Air Traffic Control Association, was formally organized March 2. Adoption of a constitution and by-laws followed at a national meeting on March 31. At press-time, a membership drive aimed at more than 10,000 civil and military controllers in the U.S. was moving into high gear.

Heading ATCA as executive director is C. P. Burton, former chief of CAA's airways operations division until his retirement early in 1954. General counsel is Oswald Ryan, former Civil Aeronautics Board chairman.

• **Purpose** of the new association, according to A. F. Pitas, a CAA controller who heads the organization committee, is not only to promote the professional stature of traffic controllers. He expects it will also serve as a medium for exchange of ideas on ATC practices and procedures, and to generally enhance recognition of the traffic control profession.

Ultimately its founders expect ATCA will be in a position to take a stand on national ATC policy issues much in the same manner that industry associations represent airlines, pilots and business aircraft operators.

Working with Pitas on the embryo organization are five other Washington controllers, all 15-year veterans. They are G. D. Tigner, J. J. Reino, C. Feyen, J. J. Moraski and F. C. Sanchez. Contributing their services on a part-time basis are key control personnel from CAA installations at Baltimore, Harrisburg, Richmond and Philadelphia.

• **ATCA organization** calls for six classes of membership — professional, member, corporation, student, associate and honorary. Tentative dues structure extends on a sliding scale from $12 annually for professional status to $3 for associates.

Plan is to form special committees on traffic control research and development, application of en route and terminal procedures, current legislation, etc. in order to formulate group policy on ATC issues. Because of the nature of the controller's assignment, which militates against extended travel to carry out committee assignments, ATCA founders expect much of this work to be handled through correspondence.

Tentative headquarters have been set up at Butler Aviation, Hangar No. 9, National Airport, Washington, D.C.

People

MANUFACTURING

New Seattle division heads for Boeing Airpline Co. are **D. B. Martin,** director of sales; **Roger P. Holman,** plant facilities mgr.; **Elwood P. Kaiser,** quality control mgr.; and **Jack Whitesel,** admin. asst. to the vice pres.-gen. mgr.

John J. Intintolo, made project engineer for CDC Control Services, Inc.'s new aviation division.

Robert L. Lowry appointed mgr. of new customer relations-GEDA product sales dept., Good year Aircraft Corp.

Lowry

Edward J. Odlum elected sr. vice pres. and **Charles Kirchner** elected vice pres.-industrial and public relations, Kaman Aircraft Corp.

Louis Fahnestock appointed director of projects administration for the Fairchild Aircraft Division.

Douglas D. Seely named mgr. of marketing administration and **J. Chester Kerr** named contracts mgr. for the Farnsworth Electronics Co.

Henry W. Harding elected president of the Laboratory for Electronics, Inc.

P. H. Bremer named chief structural engineer for Lockheed—Marietta; **W. D. Orr** named mgr. of new military relations dept. of Lockheed's missile systems division.

GOVERNMENT

Edgar B. Franklin appointed CAA deputy regional administrator in Honolulu, succeeding Enar Olson, resigned.

Mrs. Grace Biermann named acting chief of CAB's Public Information Section.

AIRLINE

George M. Shutes appointed central regional mgr.-airfreight development for American Airlines.

Edmund Stohr named mgr. of international sales and **Robert L. Desmond** mgr. of agency interline and tour sales for United Air Lines.

W. H. Piper, Northwest Airlines' supt. of communications transferred from Orient Region to Western Region, Seattle-Tacoma Airport.

Sidney Rubenfeld appointed U.S. sales mgr. for El Al Israel Airlines.

Norman J. Philion made director of travel facilitation of the Air Transport Assn.

Jack Morris named supt. of maintenance for Riddle Airlines.

HONORED

Dr. George P. Cressman of the USAF's Air Weather Service was awarded the AF's highest civilian honor, the Decoration for Exceptional Civilian Service, for his accomplishments in weather analysis and forecasting.

Wendell E. Reed, Solar Aircraft engineer, awarded the Society of Automotive Engineers' Wright Brothers Medal in recognition of his paper on his invention, the Microjet engine control, judged the best presentation on aeronautics during 1955.

West Coast Talk . . . By Fred S. Hunter

- **Delivery positions tough problem for manufacturers.**
- **They'll be toeing jets to end of runways.**

LATEST LIST of commercial airliners approved for rapid tax writeoff certificates by the Office of Defense Mobilization included 37 Eastern Air Lines Electras. Since EAL had ordered 40 of these turboprops, speculation immediately arose in the industry that Capt. Eddie Rickenbacker may have released three delivery positions to help Lockheed make a sale to some other carrier.

Hunter

Whether this be the case or not, the fact remains that the transport aircraft manufacturers have no tougher problem than this one of delivery positions. It applies both to new planes coming out and to follow-on models of popular lines. The greater the number of sales, the greater the problem. Manufacturers try to meet it by holding positions open at various points along the line. This way, a customer whose footwork may be a little slow doesn't wind up clear at the end of the line. But when the competition is stiff—as it usually is—delivery dates may be the determining factor in a sale. It's no secret, for example, that one reason American Airlines chose the Boeing 707 over the Douglas DC-8 was the Seattle manufacturer's earlier delivery schedule.

Lockheed already has stepped up the production schedule planned for the forthcoming Electra to 12/14 planes a month. Douglas is answering the cry for earlier deliveries by progressively speeding up its DC-6/7 line so that by the spring of 1957 it will be turning out 14/15 planes a month. Boosting production rates, it might be added, is no small task. Suppliers all along the line have to be able to cooperate, and this is not always easy. Engines, of course, constitute a critical item. No use to build airplanes faster if you can't get the engines faster.

* *

It's interesting to note that Boeing's operation of the 707 prototype has been completely free of engine troubles. It has been flying the plane with a group of six engines —the four original P&W J57s and two spares—and has had no failures or delays in the flight test schedule. This is typical of jet engine use.

It is a foregone conclusion the failure rate of jet engines in airline service will be appreciably lower than that of the present piston engines. It's a good thing, too, for operators like Pan American. PAA now stores spare engines at countless points along its world-spanning routes so as to have replacement engines quickly available. This is expensive enough with present-day piston engines, which can cost up to around $80,000 for a new-type Wright Turbo Compound. But it gets prohibitive with turbojet engines costing in the area of a quarter of a million dollars per copy.

* *

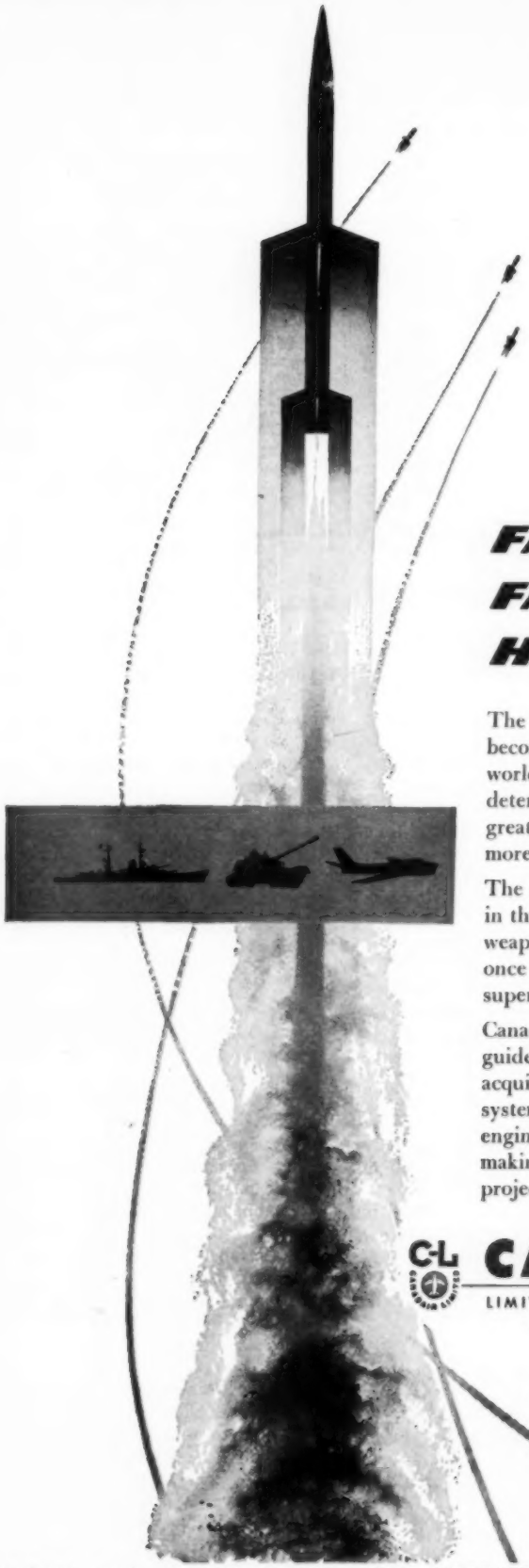
You keep hearing more talk that the airlines will decide to tow their big jet airliners out to the end of the runway before starting up the engines. Noise at the gate, of course, is one consideration. So is the cost of taxiing, estimated at $35/$40 per mile. Another is the exposure of engines to possible damage from nuts and bolts or other loose articles that might be scooped into air intakes. Runways can be kept relatively free of rocks and similar particles, but people are always dropping things around parking positions and on aprons.

* *

We discover we have readers in Florida. Well, one anyway. A recent expression of sympathy for California missile folk who get transferred to the Florida test ranges brought a quick response from ex-Californian Stu Skidmore who works for ex-Californian Ray Tonks at Aerodex in Miami. The original California contingent in Florida arrived at Aerodex four years ago last month and the group, Stu hastens to report, still greatly enjoys "this sub-tropical climate, the clean air, sunshine and blue skies." What he really means is they like the fishing.

* *

Boeing plans to use six, perhaps eight, planes in its CAA type-certification flight-test program on the 707 jet transport. Douglas will use seven DC-8s. About 20% of the flight-test work with the Boeing 707 prototype will be applicable to the CAA certification program.



FASTER
FARTHER
HIGHER

The development of guided missiles of every type is becoming one of the most competitive areas in our world today . . . for supremacy in this field can well determine peace for many years. The race is now for greater speed, higher altitude, longer range, more sensitive control.

The strength of Western defense lies to a great extent in the development for the Armed Forces of these new weapons systems suited to the supersonic age. The once deadly cannon, machine gun and rocket are being superseded by complex weapons of great ingenuity.

Canadair has long had a prominent role in Canada's guided missile program, applying the knowledge acquired in years of experience in advanced aircraft systems engineering . . . and Canadair's research, engineering and manufacturing resources are constantly making further important contributions to projects in this field.

C-L **CANADAIR**

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CAN-1017

CANADAIR HAS PRODUCED MORE JET AIRCRAFT THAN ANY OTHER CANADIAN MANUFACTURER

Crash May Bring Flight Rules Changes

Findings of Civil Aeronautics Board's investigation of the crash of a Beech Bonanza piloted by wealthy playboy Joel Thorne into a North Hollywood, Calif. apartment last October are taking the shape of new regulations.

CAB is proposing changes to Parts 40 and 60 to clearly state visual flight minimums for operations within air traffic control zones with a traffic clearance.

Essentially, they will specify that a pilot must not operate an aircraft under instrument rules (IFR), or in weather below VFR minimums, unless he holds a valid instrument rating.

If adopted, aircraft could not legally be flown beneath a ceiling of less than 1,000 ft. without an ATC clearance.

Also, they could not be operated closer than 500 ft. vertically under, 1,000 ft. vertically over, or 2,000 ft. horizontally from any cloud.

During CAB hearings last December on the Thorne accident, CAA officials expressed dissatisfaction with rules governing flights with control zones. Their main contention was that there was no clear delineation to distinguish IFR and VFR flight conditions, and as a result, the agency lacked sufficient grounds to take enforcement action against violators.

Board has set May 25 as deadline for industry comment on the proposed changes.

Shortage of Technicians Called Threat to U.S.

The federal government must lead in a "crash program" to increase the number of well-trained U.S. technical personnel, a Congressional subcommittee said. It warned that the U.S. is in "desperate danger" of falling behind Russia in training engineers and scientists.

"The time has come for strenuous measures, for action by the government, by business corporations, and universities," said Rep. Melvin Price, (D.-Ill.), chairman of the Joint Atomic Energy Committee's research and development subcommittee. "A decisive federal program can stimulate the cooperation needed. . ."

The U.S., he added, "is scarcely even with the Soviet Union as regards numbers of engineers and has only a slight lead in numbers of scientists. From here on, the Russians show promise of widening the difference—and to our disadvantage."

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Quarles to Review AF Regulations Labeled 'Socialistic' by AIA

Air Force Secretary Quarles and Aircraft Industries Association President DeWitt C. Ramsey were scheduled to meet in the Pentagon last week to discuss new USAF regulations which a recent AIA resolution called "socialization" and "not to the advantage of the United States."

The regulations (AF Procurement Circulars 1 and 10) call for such items as:

- Submission of list of subcontractors when an aircraft company makes a bid for a new USAF contract.
- Approval by the administrative contracting officer (with AMC concurrence) of all salaries over $25,000.
- Examination of all salaries over $15,000 on an individual basis.
- Needed approval by the contracting officer of all salary and wage adjustments regardless of whether those increases are the result of collective bargaining agreements.
- Elimination of per diem and incentive payments to contractor personnel at remote USAF test bases.
- Not approving wage and salary structures which include incentive pay except under unusual circumstances.
- Providing the USAF with information management uses in planning production, e.g., manpower hiring schedules, materials purchases, special tooling, subcontractors, engineering and production releases.

Aviation companies maintain that these are efforts by the USAF to infringe on their responsibilities and will give military officers power to countermand plans of top-level company executives.

Newest Fighter

Newest of Air Force's Century series of supersonic fighters is straight-wing Lockheed F-104 Starfighter, reportedly flown at Mach 2 in level flight. Prototype XF-104 here is powered by Wright J65, production model (below) uses General Electric's J79.

Two A-Plane Versions Are Being Built

Although several airframe and engine companies have been working on paper studies of an atomic airplane for the USAF for several years, it is now clear that only two versions will be built.

Lockheed and Convair will produce atomic airframes, working in cooperation with Pratt & Whitney and General Electric, respectively, on the powerplants. Boeing and Curtiss-Wright hold no contracts for hardware, although they have done paper studies.

The USAF officially announced that:

- **Convair-Ft. Worth** has been awarded a contract to develop an airframe for an atomic plane. The award stems directly from an original study contract awarded in 1951, Convair officials said. The company has for several months been flying its own nuclear reactor in a B-36 to study shielding problems.
- **Lockheed Aircraft** will build the nation's largest atomic research and development facility at Dawsonville, Ga., 50 miles north of the Marietta plant. The new facility will be mostly USAF-financed, but Lockheed will also put several million dollars of its own funds into the project. Construction will start this spring. About 500 skilled technicians will eventually be employed.
- **USAF will build** a $7.5 million atomic reactor at Wright Air Development Center, Dayton, O., to test materials, components and systems for atomic planes.

Lockheed's facility will have two reactors widely separated, but connected by a remotely-controlled narrow-gage railroad.

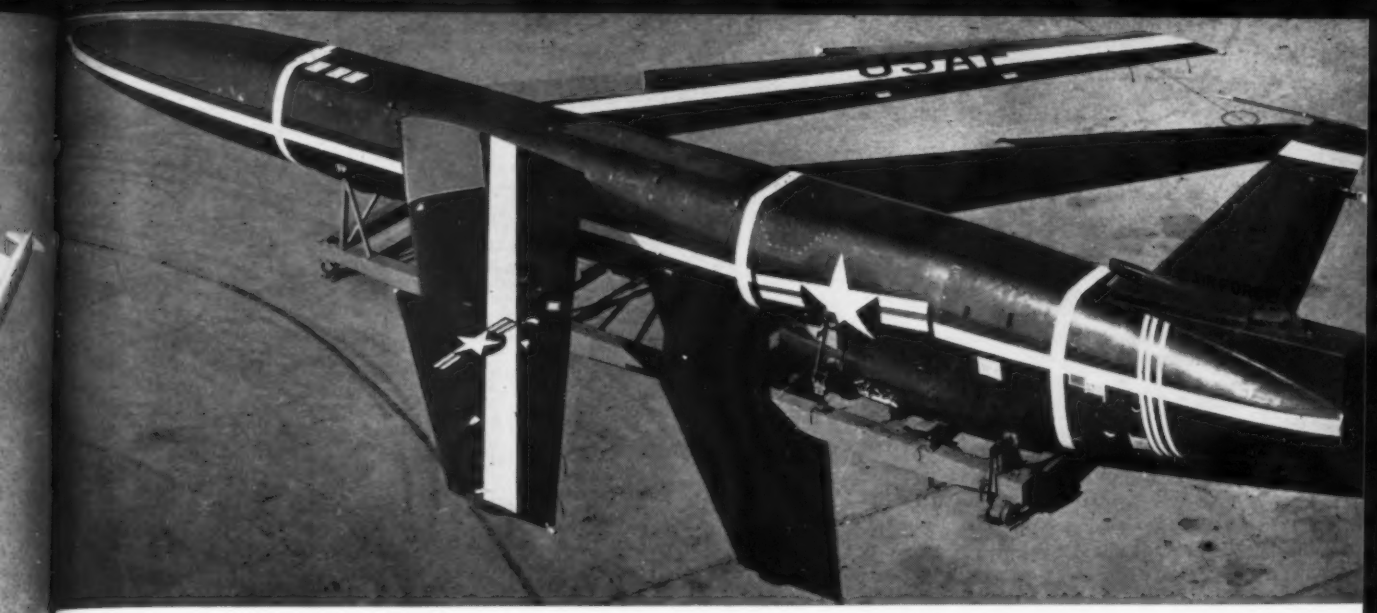
Concurrent with the USAF announcements, the Navy revealed that it is accelerating the development of an atomic-powered seaplane.

Navy, Martin Name Vanguard Subcontractors

Four new Project Vanguard subcontractors, including companies that will supply the third-stage rocket for

Production Version of Supersonic F-104

First photo of production F-104A, recently rolled out at Lockheed's California Div., reveals thin-wing and T-tail design. Horizontal stabilizer has no elevator, but moves as a unit. Dummy cover hides inlet of F-104A's G.E. J79 engine for security reasons.



New View of Long-Range Snark Missile

Swept-wing Northrop SM-62 Snark missile, now in pre-production test phase, is one of two USAF forerunners to 5,000-mile range intercontinental ballistic missiles, the Convair Atlas and Martin Titan. Other is North American SM-64 Navaho. Northrop developed airframe, guidance system and support equipment for Snark.

the earth-circling satellite, have been announced by the Navy and The Glenn L. Martin Co. The subcontractors:

• Grand Central Rocket Co., Redlands, Calif., and Allegany Ballistics Laboratory, Cumberland, Md., will design and develop the third stage. This will be a solid propellant rocket providing the last thrust needed to place the satellite in a temporary orbit about the earth.

• Minneapolis-Honeywell Regulator Co., Minneapolis, will design and build the three-axis reference system of gyros which will indicate the vehicle's roll, pitch and yaw. This information will be transmitted to a magnetic amplifier autopilot which will control the position of the rocket engines of the first two stages in their gimbals and thus direct the course of the vehicle.

• Vickers Electric Div., Vickers, Inc., St. Louis, will design and manufacture the autopilot. Vickers is a unit of Sperry-Rand Corp.

Martin is building the overall airframe of the Vanguard. General Electric will supply the engine for the first stage and Aerojet-General Corp. the engine for the second stage.

Air Force, Navy to Ask More Money in '58

As the Administration asked Congress for an additional $547 million in defense funds for fiscal 1957, both the Air Force and the Navy looked another year ahead and told the legislators they will need substantially more money for airplanes in fiscal 1958.

It was indicated that about half of the $547 million, which was requested for all three military services, will be used to step up B-52 production. The output rate of the jet bomber has been a target of the Democrats in Congress.

• **USAF had previously** indicated it will need between $18 and $20 billion in fiscal 1958, against a proposed $16.5 billion in fiscal 1957, in order to maintain a 137-wing force (AMERICAN AVIATION, April 9). Later it was revealed that Gen. Nathan Twining, Chief of Staff, had told the House Military Appropriations subcommittee that USAF had enough money to buy planes in fiscal 1957, but needed funds for other purposes.

"We do not want any more money on airplanes for this particular year (1957) if we get the increased aircraft procurement funds we will need next year," he said. "I think what the Air Force could really do if additional money were available is speed up the

Snark Takes Off

Rocket-boosted Northrop SM-62 Snark intercontinental missile "takes off" from launcher during proving tests at Air Force's Patrick AFB, Fla. missile test center. Still to be ordered into mass production, Snark was recently fired 2,000 miles. Powerplant is "air-breathing" Allison J71 jet.

Parrish to Get Award for Contribution To Progress of Aviation Writing

Wayne W. Parrish, editor and publisher of American Aviation Publications, has been designated by the Federation Aeronautique Internationale to receive a Paul Tissandier Diploma for his contribution to the progress of aviation writing. Award will be made at the international organization's 1956 General Assembly in Vienna, May 17-21.

The De La Vaux Medal will go to Col. Horace A. Haines, USAF, for a world speed record of 822.266 miles per hour over a fixed straightaway course of approximately 18 kilometers. Record was set Aug. 20, 1955, at Palmdale, Calif., in a North American F-100C.

Also to receive Paul Tissandier Diplomas are Col. Roscoe Turner, Indianapolis, for contribution to the progress of sporting aviation; William T. Piper, president of Piper Aircraft Corp., Lock Haven, Pa., for contribution to the manufacture of light aircraft, and Frank Zaic, New York City, for contribution to progress of model aeronautics.

public works program, build faster, get these bases ready sooner; in research and development expand and accelerate our programs, and in operations and maintenance, if we get at least the funds we requested this year, then we will be all right."

Twining added that "operations and maintenance funds are again a critical problem. We suffered this year very badly. The outfits had to stop operating to some extent—reduce their operations."

• **The Navy** told the same subcommittee the same story about fiscal 1958. Preliminary planning for that year "indicates an increase in aircraft procurement in comparison to fiscal 1957" (when 1,468 new planes will be ordered), Vice Adm. T. S. Combs, Deputy Chief of Naval Operations (Air), testified.

The 1,468 planes will be augmented by aircraft ordered with money for previous years, he said. "It is in the area of prior procurement that our numbers next year and the year following will decrease." To hold a 2,000-planes-a-year-level, more aircraft will have to be ordered because fewer planes will be delivered from prior programs, he added.

The Navy also revealed that it included funds in its fiscal 1957 budget to begin production engineering and to buy long lead-time tooling and materiel for two new aircraft models, neither of which was identified. About $2.9 million has been set aside for research on one plane, and $4 million on the other.

CAA Launches Study Of Jet Age Needs

CAA has initiated an intensive research program to determine the requirements for the jet age. Being directed by the Office of Program Planning, the study will encompass all facets, exclusive of certification, including: safety, air traffic control, crash and rescue, fuel storage and handling, runways, taxiways, ramp servicing, loading areas and buildings.

CAA will act as a clearing house for gathering the data, checking with industry and other government agencies. Interim reports will be issued quarterly with the first to be released on June 30. Joseph D. Blatt, assistant administrator for programming, told AMERICAN AVIATION the final report would be out by June 30, 1957. It is felt that by that date sufficient data in major areas would be ready for communities to begin planning.

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officer, has been designated central coordinator. CAA Offices of Airports, Airways and Safety will each designate a representative to work with him.

The study has been launched in line with a promise made by CAA Administrator Charles J. Lowen at January's CAA Jet Transport Meeting in Washington. He said at that time that CAA would serve as "a catalyst" in determining requirements.

4,820 Civilian Planes Shipped in 1955

A total of 4,820 civilian planes weighing 10,230,500 airframe pounds and worth $271,300,000 was shipped by the U.S. aircraft industry in 1955, according to the Bureau of the Census and CAA.

Number of complete plane shipments was up from 3,389 in 1954, but total weight was off 3%. Value of shipments dropped 8% from 1954's $295,738,000.

Shipment of planes 3,000 lbs. and over dropped 18% from $254,300,000 in 1954 to $208,100,000 last year. Total airframe weight was down 24%. Backlog of civil planes in the same category at the end of 1955 was 752 planes, up 507 from 1954.

Engine shipments for civil planes last year totaled 7639 units of 3,337,400 horsepower, up 38% in number, down 1% in horsepower. Value of engines was $59,100,000, or 2% under 1954's $60,600,000.

Douglas Has DC-9 Jet In Works For 1961

Douglas Aircraft Co. is working on a medium-range jet and a DC-3 replacement. The new jet transport, the DC-9, is to be made available for medium-range airline operations starting in 1961. It will gross 110,000 lbs., cruise at 600 mph, and be powered by four Pratt & Whitney J52s (a two-spool engine rated at about 7,500 lbs. thrust which has been under development by P&W for the Navy at low priority for a number of years).

Meanwhile, J. B. Edwards, assistant to the chief engineer of Douglas' Santa Monica Division has revealed that the company is planning a replacement for the DC-3. The project is still five years off, he said.

Edwards, who was project engineer on the DC-4, DC-6 and DC-7, said that emphasis in the new plane will be on short takeoff. It would carry about 40 passengers or a big freight load, but would be able to fly from small airfields.

It will feature a straight, high wing

Eastern Invests $381,000,000 in the New Age of Air Travel

In 1955, Eastern Air Lines embarked on the largest fleet expansion program in the history of the industry. Costing $381,000,000, this program will equip Eastern with the world's most advanced piston-engine, prop-jet, and straight jet airliners.

The first phase of this great three-part program calls for 50 turbo-compound powered aircraft of the most modern types. Forty of these transports will be Golden Falcon DC-7B's, and ten will be Lockheed Super-G Constellations. The first components of this luxury fleet are already in service on many of Eastern's routes.

The second part of Eastern's fleet expansion plan involves the purchase of 40 Lockheed Electra prop-jet airliners. Designed to carry 66 first-class or 91 aircoach passengers at speeds of well over 400 miles an hour, Eastern Electras will be in service in the fall of 1958.

The final stage provides for 20 Douglas DC-8 jet transports, capable of carrying from 115 to over 140 passengers at 550-600 miles an hour. Scheduled for delivery starting in May, 1959, these magnificent airliners will link the greatest industrial centers and most popular vacation areas in the United States and the Caribbean.

With this unprecedented fleet expansion program, Eastern Air Lines proclaims its faith in the limitless future of air transportation. We are standing at the threshold of the jet age—an age that will bring immeasurable benefits to the public in the years to come. Eastern is proud to be one of the pioneers in this great new age of air travel.

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of large area with very big flaps; fuselage low to the ground for easy loading; powerful turboprop engines for fast climb off the ground; cruising speed of about 345 mph; low maintenance and operating costs for short range work up to 1,000 miles.

The big wing area, the big flaps and the powerful engines would all help in giving short takeoffs and landings, but Douglas would use still-secret devices to aid this, Edwards stated.

Smathers Asks Changes In Air Pact Practices

Major changes in international air agreement negotiating practices of the State Department and Civil Aeronautics Board can be expected as a result of a strongly-worded report issued by the Smathers subcommittee of the Senate Interstate & Foreign Commerce Committee.

The group, headed by Sen. Geo. A. Smathers (D-Fla.), directed State and CAB to give U.S. airline interests an active role in future negotiations, consider U.S. airline interests when bargaining with foreign countries, and seek to implement Bermuda principles embodied in existing air agreements.

The report was directed to the entire U.S. bilateral picture although its impetus came from last year's agreement in which the German airline Lufthansa was given what the Smather's group considered "the best of the bargain."

The subcommittee endorsed the Bermuda-type agreement used by the U.S. with foreign countries but felt the U.S. has been "too generous" in carrying out the agreements.

Eastern To Use J75 Jets in DC-8s

Eastern Air Lines will use the more powerful Pratt & Whitney J75 engines in all of its DC-8 jets instead of installing the J57 in the first six, as originally planned. The company has also ordered two more DC-8s, bringing its total to 20.

EAL revealed that it has released to Lockheed the early delivery dates set for its 30 Electra turboprops on option. Under the new agreement, delivery of the optioned planes will start in February, 1961, instead of August 1959. Delivery of the 40 Electras now on order will start in August, 1958.

Switch to J75s was made possible by a three-month acceleration of delivery of DC-8s using these engines, bringing them within three months of the original schedule for J57 versions.

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EAL also estimated it would have cost $1,250,000 to convert later to J75s, plus two months per airplane out-of-service time.

Nationalist China Tests New Helicopter

CJC-3A helicopter designed by Maj. Gen. C. J. Chu, head of Nationalist China's Aircraft Production Bureau, for the use of the Nationalist Chinese air forces, is now being flight-tested.

General Chu has been working for some years on the development of rotary-wing aircraft. In 1944 an experimental model of his design—the CJC-1A—was built, but was destroyed before it could begin flight-testing. In 1948 a later development, the CJC-2, was completed, but it was not in the air during the civil war on Chinese mainland.

The CJC-3A now undergoing tests is fitted with a 190-hp Lycoming engine. Characteristics and performance are as follows:

Rotor diameter	24 ft., 8 in.
Overall length	32 ft., 10 in.
Overall height	9 ft., 10 in.
Weight empty	1,500 lbs.
Useful load	500 lbs.
Max. speed at S.L.	112 mph
Max. vertical rate of climb	546 fpm
Max. oblique rate of climb	1,530 fpm
Hovering ceiling	7,400 ft.

Pentagon Releases GE Jet For Commercial Use

The General Electric CJ-805 jet engine, commercial version of the J79, has been released by the Department of Defense for commercial use. This is the Convair Skylark 600's powerplant.

Convair gives the jet transport's cruising speed at 609 mph. Direct operating costs of the Skylark 600, based on the first class configuration of 80 passengers—will range between 1.4¢ and 1.7¢ per seat mile. Over a 500-mile stage, the aircraft will have a block speed of 413 mph. On a 1,000-mile stage the block speed will be 470 mph and on a 1,500-mile stage it will be 504 mph.

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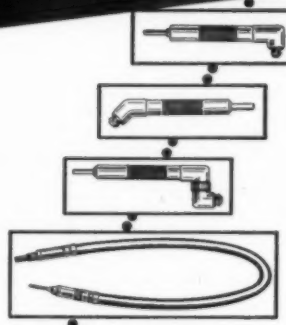

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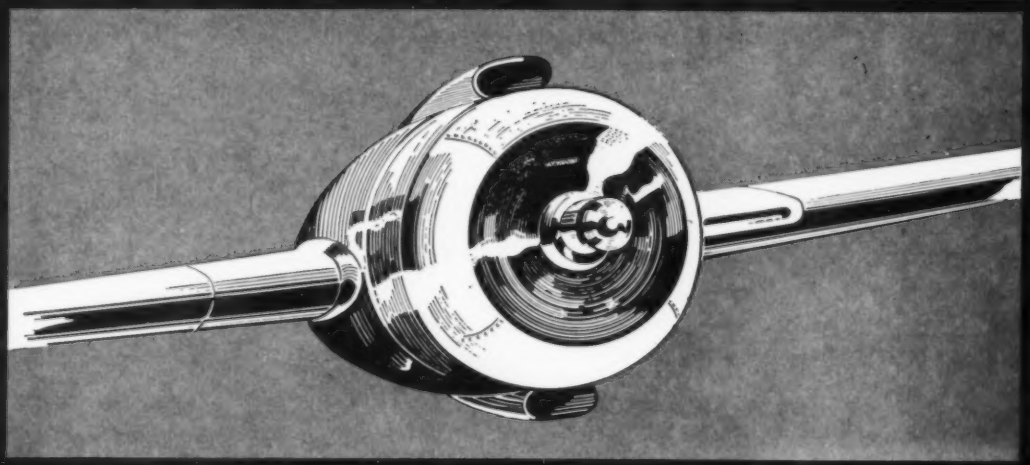

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airline operation." Describing it as "the most advanced engine available for commercial applications," General Electric claims that it will produce more thrust per pound of engine weight than any other engine in its power class.

New White House Rule Favors Nonskeds

President Eisenhower early this month authorized CAB to lift its stay of "overseas and territorial" phases of the Large Irregular Air Carrier decision. But the President ordered that any Board decisions dealing with "foreign" non-sked operations should be submitted for White House approval.

Thus, new liberal authorizations for non-skeds may now be implemented in domestic, overseas and territorial operations, but not in foreign, which is described as between a point in the U.S. and a point in a foreign country.

Board's over-all decision in the case, meanwhile, is pending action by the U.S. Court of Appeals, District of Columbia Circuit. A pre-summer ruling by the Court is likely.

Eleven Firms Received 38.2% of Military Work

Eleven companies manufacturing aviation products received a total of 38.2% of all government military contracts in the six months ending June 30, 1955. The companies and total contracts (dollar figures in millions):

North American Aviation, $646.2; General Dynamics, $374.4; Boeing, $368.1; United Aircraft, $321.3; Curtiss-Wright, $281.5; General Electric, $268.8; General Motors, $235; Douglas, $209.1; Lockheed, $193.1; Ford Motor Co., $191; Hughes Tool, $171.

Comptroller General Urges CAB Fare Probe

The U.S. Comptroller General, Joseph Campbell, this month urged the Civil Aeronautics Board to institute a "full-scale investigation" of the domestic airline passenger fare structure.

In a 115-page report of the General Accounting Office, reflecting an audit of CAB, such an investigation was termed "essential."

Campbell said CAB has advised "that it will again give consideration to the need for a formal investigation . . ." Immediately upon release of the

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report, Campbell was invited to testify before the Celler monopoly subcommittee in the House when hearings on aviation resume on May 2.

The Celler hearings in recess since March 28, are pointing to a general fare investigation by CAB.

The GAO report also urged Congress to establish a CAB Subsidy Administrator and a contract method for determination of subsidy amounts. It further urged a limit on subsidized airlines' executives' salaries.

F-27 Gets More Takeoff Thrust

With 50 flying hours logged, the Fokker F-27 Friendship prototype's present Dart 507 engines with 10-ft. Rotol propellers are being replaced by Dart 511s with 12-ft Rotol propellers, scheduled to be installed in production aircraft. This change will increase available takeoff thrust by about 15%.

The second prototype is now ready for its static test program. The fuselage and wing center section have been placed in the test tank. After pressure testing the fuselage, the outer wings will be fitted to submit the aircraft to combined loadings of critical flight conditions and fuselage pressure.

Progress is being made on the third prototype. The main assembly of the fuselage, center wing and engine nacelles is well advanced. De-icing will be thermal for the wing leading edges by means of heat, drawn from the exhaust, while de-icing of the empennage will be electric.

•**The first prototype** will, however, be experimentally fitted with rubber de-icing boots, with chordwise inflation chambers. In order to obtain a smooth surface when deflated, these rubber boots will be molded into the reinforced plastic wing leading edges. Furthermore, the plastic leading edges of the wing will be fully interchangeable thus simplifying maintenance.

The design of the pressurization system has been finalized. It consists of: 1) Roots type cabin blowers on both engines; 2) choke heating; 3) intercooler (provision has been made for a secondary intercooler and the turbine cooling unit); and 4) pressure and temperature regulating equipment.

Upon request of several airlines which have to operate from secondary airfields, Fokker has decided to incorporate a modification in the production aircraft, allowing the optional use of larger tires with the result that the tire pressure of the main landing gear can be reduced to approximately 60 lbs./sq. in. The front fuselage, bottom section and nacelles of the fourth prototype are now in their jigs. This prototype will be used for fatigue testing.

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b. 2500 hours flown on long range - and European routes.

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News Briefs

MANUFACTURING MILITARY

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report, Campbell was invited to testify before the Celler monopoly subcommittee in the House when hearings on aviation resume on May 2.

The Celler hearings in recess since March 28, are pointing to a general fare investigation by CAB.

The GAO report also urged Congress to establish a CAB Subsidy Administrator and a contract method for determination of subsidy amounts. It further urged a limit on subsidized airlines' executives' salaries.

F-27 Gets More Takeoff Thrust

With 50 flying hours logged, the Fokker F-27 Friendship prototype's present Dart 507 engines with 10-ft. Rotol propellers are being replaced by Dart 511s with 12-ft Rotol propellers, scheduled to be installed in production aircraft. This change will increase available takeoff thrust by about 15%.

The second prototype is now ready for its static test program. The fuselage and wing center section have been placed in the test tank. After pressure testing the fuselage, the outer wings will be fitted to submit the aircraft to combined loadings of critical flight conditions and fuselage pressure.

Progress is being made on the third prototype. The main assembly of the fuselage, center wing and engine nacelles is well advanced. De-icing will be thermal for the wing leading edges by means of heat, drawn from the exhaust, while de-icing of the empennage will be electric.

•**The first prototype** will, however, be experimentally fitted with rubber de-icing boots, with chordwise inflation chambers. In order to obtain a smooth surface when deflated, these rubber boots will be molded into the reinforced plastic wing leading edges. Furthermore, the plastic leading edges of the wing will be fully interchangeable thus simplifying maintenance.

The design of the pressurization system has been finalized. It consists of: 1) Roots type cabin blowers on both engines; 2) choke heating; 3) intercooler (provision has been made for a secondary intercooler and the turbine cooling unit); and 4) pressure and temperature regulating equipment.

Upon request of several airlines which have to operate from secondary airfields, Fokker has decided to incorporate a modification in the production aircraft, allowing the optional use of larger tires with the result that the tire pressure of the main landing gear can be reduced to approximately 60 lbs./sq. in. The front fuselage, bottom section and nacelles of the fourth prototype are now in their jigs. This prototype will be used for fatigue testing.

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at Chicago. Disposition of the plane, still undetermined, is in the hands of Aero Associates, New York, U.S. representative of interests insuring the company's turboprops.

Western Air Lines will open service May 1 on its new San Francisco-Salt Lake City-Denver route.

California Eastern Aviation ordered three 1049H Super Constellations from Lockheed, with deliveries starting in late spring of 1957.

Scandinavian Airlines System has selected the Pratt & Whitney JT4 (J75) to power its fleet of seven Douglas DC-8 jet transports.

United Air Lines stockholders authorized the company to increase authorization for issuance of preferred stock from 300,000 to 600,000 shares ($100 par). UAL emphasized, however, that there is no immediate need for the additional financing made possible.

• **Pan American World Airways** will retire its Constellations and Convair 240s next fall.

• **TWA** completed the move to its new $5.5 million engine overhaul facility at Kansas City's Mid-Continent Airport. The overhaul plant is part of a $25 million investment TWA is making at the airport.

• **American Airlines** in 1955 became the first airline in the world to carry more than 7 million passengers in a year. The 7.3 million passenger total was more than twice the number carried in 1950. AA also carried 69.5 million freight ton-miles, a new industry high.

• **Aircraft Engineering Foundation's** "Super C-46" has been certificated by CAA.

• **Trans-Canada Air Lines** said that in the first eight months of Viscount operations each plane had average utilization of eight hours a day. Utilization per revenue aircraft was seven hours.

Announced Turbine Transport Orders

AS OF APRIL 10, 1956

AIRLINE	TYPE	NO.	DELIVERY
Aer Lingus	Fokker F-27	4	Late 1958
Aer Lingus	Viscount	7	In Progress
Air Austria	Viscount	4	1957
Air France	Viscount	12	Completed
Air France	Caravelle	12	1958
Air France	707	10	1960
American	Electra	35	August 1958
American	707	30	March 1959
BEA	Viscount	67	In Progress
BEA	Vanguard	20	1959/60
BOAC	Britannia	33	In Progress
BOAC	Viscount	8	1957
BOAC	Comet 4	19	1958
Braathens	Viscount	1	In Progress
Braniff	707	5	October 1959
Braniff	Electra	9	May 1959
Butler	Viscount	2	Completed
BWIA	Viscount	8	In Progress
Canadian Pacific	Britannia	4	1957
Capital	Viscount	60	In Progress
Central African	Viscount	5	Spring 1956
Continental	Viscount	15	1958
Continental	707	4	May 1959
Cubana	Viscount	3	Early 1956
Delta	DC-8	6	June 1959
Eastern	Electra	40	August 1958
Eastern	DC-8	19	May 1959
El Al	Britannia	3	March 1957
Hongkong Airways	Viscount	2	Late 1956
Hunting-Clan	Viscount	5	In Progress
Indian Airlines	Viscount	5	Late 1957
Iranian Airways	Viscount	3	1958
Iraqi Airways	Viscount	4	In Progress
Japan Air Lines	DC-8	4	1960
KLM	DC-8	8	March 1960
KLM	Electra	12	September 1957
KLM	Viscount	9	1957
KLM	Fokker F-27	2	1957/58
LAV	Viscount	3	Completed
Lufthansa	Viscount	7	1958/59
Mackey	Fokker F-27	2	Late 1957
Misrair	Viscount	3	Completed
National	DC-8	6	Early 1959
National	Electra	23	April 1959
NZNAC	Viscount	3	Late 1957
Fred Olsen	Viscount	6	In Progress
PAA	707	23	December 1958
PAA	DC-8	21	December 1959
PANAGRA	DC-8	4	Early 1960
Philippine Air Lines	Viscount	2	1958
SAA	Viscount	7	1958
Sabena	707	4	1960
SAS	DC-8	7	Early 1960
Swissair	DC-8	2	Spring 1960
TAA	Viscount	11	In Progress
TCA	Viscount	36	In Progress
Transair	Viscount	2	Mid-1957
TWA	707	8	April 1959
United	DC-8	30	May 1959
Union of Burma	Viscount	3	Early 1957

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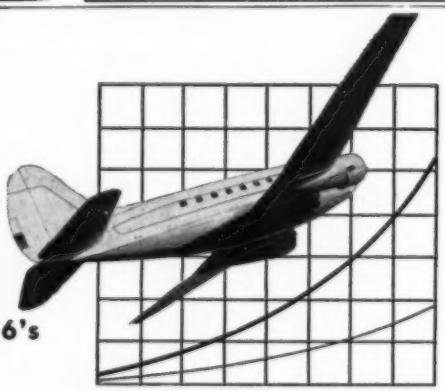

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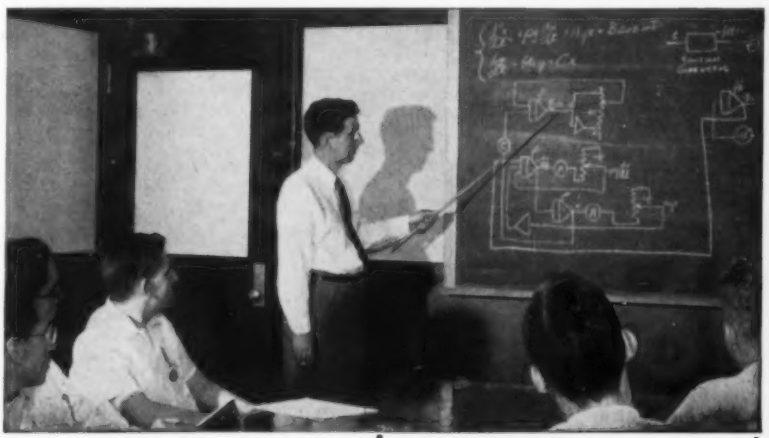

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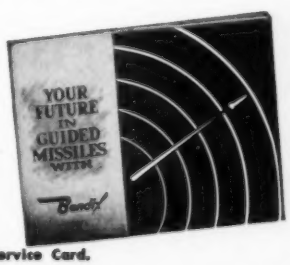

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EN ROUTE . . .

WAYNE W. PARRISH

The Red Arrow Wings Into Moscow

Although I had slept fitfully during most of the night I must have fallen sound asleep about dawn because when I awakened and looked at my watch it was 8:30. I could see daylight through the compartment curtain.

I sleep in so many different places that I always go through that momentary flash of regaining consciousness to determine where I am. This time I realized I was on a train, quite a rare occurrence for me. In nothing flat I got my bearings. Of course, I was still on the Red Arrow midnight express between Leningrad and Moscow. It was no dream. This was it. And how could I have slept so late when I had intended being up at dawn to watch the countryside?

In a rush I opened the curtains and looked out. It was daylight, but wintery grey. It was snowing (as usual). We were passing through country of open fields patched with woods. There were clusters of evergreens cloaked with snow, one of nature's most wonderful sights. Then we passed a village with its wooden houses clinging close together and footpaths through the snow. No life was discernible. It was a real winter scene.

385 Miles Straight Track

Without missing anything outside, I dressed quickly. Then I washed my face in the washroom I shared with the adjoining compartment, deciding to pass up shaving until I got to my hotel in Moscow. The train was moving at about 40 or 45 miles an hour. And I should mention that the tracks were absolutely straight for 385 miles. Sometime last century a czar drew a straight line between Moscow and Leningrad and gave orders to build a railroad without a bend anywhere. (The dictatorial approach in Russia wasn't new with Stalin).

The Red Arrow after arrival in Moscow. Photo snapped by Lennart Rehnqvist of SAS.

The porter was alert to my getting up because he knocked on my door and mentioned the only Russian word I knew—for tea. I nodded yes. It was quite welcome. Then a girl came through the car with a basket of salami, caviar and rolls. (There was no diner.) Salami not being my idea of a cozy breakfast, and caviar not being to my liking at any time of day or night, I picked out a large roll that had some sort of sugary stuff on top.

Mr. P. Gets Surprise

I had heard the jingling of coins in her pocket, so I assumed there was a charge. I held in my hand all of the ruble and kopek coins I had so she could pick out the right amount. By all the saints and sinners of this cock-eyed globe if she didn't grab up every dadgummed coin and prance out of the compartment with some expression that must have meant thanks. I don't know how much change I had but I made a little note that I was making a liberal contribution to the consumer economy of the U.S.S.R. and began eating the most expensive sweet roll to be found outside the Beverly Hilton in Los Angeles.

(I found out that Communism doesn't mean share the wealth, it means take it all away. They must have learned the technique from Chicago taxi drivers!)

While sitting at my table by the window drinking tea and eating my roll and feeling danged proud of myself for being on the Red Arrow Moscow-bound, there came into the train view a sight which made my heart leap with excitement.

Prison Camp Or - - - ?

Right before my eyes and below the track level was a layout which fit exactly the pattern of a concentration camp I had seen described in detail only recently in an American magazine. Could it be, I asked myself, that as a tourist I was actually seeing one of these things?

Naturally I have no idea whether it was an ordinary prison camp for criminals or a political prison or a slave camp or what. But there was the tall outer stockade rimmed with barbed wire.

The guard houses were not in the corners, but midway along the three sides within my view. Searchlights were in the corners. Then there was an inner and somewhat lower stockade, also rimmed with barbed wire, separated from the outer stockade by a clear passageway or "moat" about fifteen or twenty feet in width. The guards had a perfectly clear view of the "moat", making it extremely difficult if not impossible for anyone to escape.

I couldn't tell how far the camp stretched away from the tracks because it disappeared beyond a hill, but in my view were wooden barracks of various dimensions. In the yard were a few figures standing in the snow. I had only a passing moment to take in the whole scene but I was struck by the fact that it fitted exactly the description I had read not so long ago. By my watch we were just one hour west of Moscow. So if you go by train, look for this camp north of the tracks by timing your schedule.

We passed through several small factory towns. The buildings were lighted to compensate for the dull daylight and there were people and trucks moving about. Whenever a road came into view I noted that it was not paved and that traffic hadn't been too heavy. In passing villages I noted that there were mainly footpaths through the snow-covered streets.

Suddenly It's Moscow

More trains began passing us from the opposite direction and then I spotted some electric commuter-type trains and realized we were getting near Moscow. The towns became larger. We were due to arrive at 9:45 but clear up to within five minutes of arrival we were still in open country interspersed with villages and towns. Quite suddenly we arrived within the city and in only a few minutes we were at the main station. Russian cities are very compact. It was quite a contrast to the long trek through suburbs and industrial areas to the center of any large American city.

So here I was in Moscow. Hardly before I had time to put on my coat an Intourist representative accompanied by a porter had sought out my compartment and welcomed me in friendly style to the Soviet capital. We left the car along with the military brass and other elite and walked down the open station platform and there waiting for me with camera in hand was my old friend Lennart Rehnqvist, the Scandinavian Airlines manager for Helsinki who was in Moscow on business.

He snapped several photos and bid me welcome. So Moscow wasn't so cold after all. With a reception committee of two, I was really living it up.

(To be continued)

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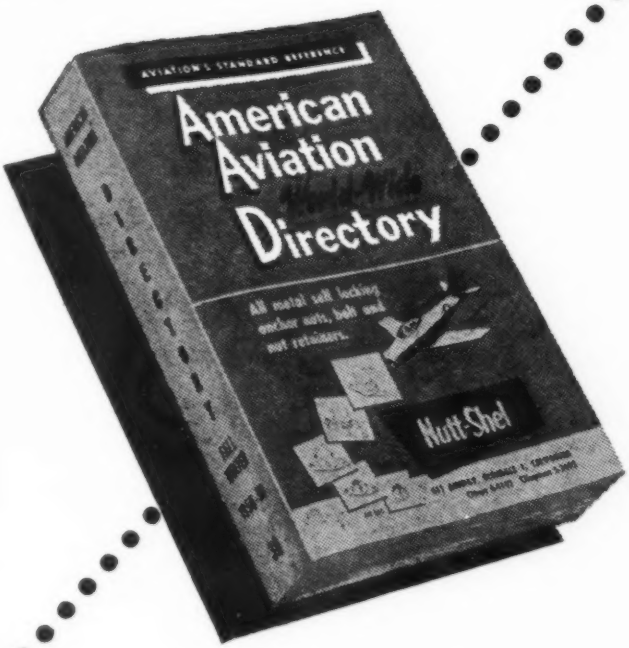
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SAFETY INSTRUCTIONS. The Agricultural Aircraft Association, Inc. offers copies of Delta Air Lines' instructions to its aerial applicator personnel, compiled under the direction of Dr. B. R. Coad, manager of the company's agricultural division.
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SYNCHROS AND SERVO MOTORS. Characteristics of some 140 synchros, servo motors and resolvers are given in Bulletin 376 issued by Norden-Ketay Corp. Another bulletin, No. 380, gives specifications and characteristics of gyros and potentiometers made by the company's Gyromechanisms Division.
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TANDEM TRANSISTORS. Marvelco Electronics Div., National Aircraft Corp. offers a 4-page technical bulletin on its new tandem transistor, containing illustrations of circuitry, specifications and applications.
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TUBULAR PRODUCTS. A 4-page folder (TDC-182) containing information about machining operations on seamless and welded tubular products, including aircraft tubing, is available from the Babcock & Wilcox Co.
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ELECTRONIC TUBES. Chatham Electronics Div., Gera Corp. has issued a 4-page folder describing its rectifiers, twin power triodes, voltage regulators and reference tubes, thyratrons, clipper diodes and special-purpose tubes.
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VOLTAGE REGULATORS. A bulletin offered by Arga Div., Beckman Instruments, Inc. describes three types of ac voltage regulators that combine magnetic and transistor components. Another Arga bulletin describes frequency limit indicators.
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FILTERS. Cuno Engineering Corp. has issued a 4-page catalog (MK-170) describing its new high-capacity Micro-Klean filter for gasoline and aviation fuels, process liquids, water, Diesel fuel and lubricants.
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CHEMICAL WIRE STRIPPERS. A 4-page folder describing Lonco chemical wire strippers for stripping magnet wire insulation from armature and coil leads is offered by London Chemical Co., Inc.
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Several research reports for the Air Force and one report of the Civil Aeronautics Administration are available from the Office of Technical Services, U.S. Department of Commerce.

AF reports are:

PB 111764, Development of Room-Temperature-Curing Structural Adhesives for Metals, Bjorkstein Research Laboratories, Inc. 89pp. Price, $2.25. Supplement, PB 111764S, same title. 49pp. Price, $1.25. The report describes testing procedures that led to the development of metal-to-metal adhesive suitable for the fabrication and field repair of certain airframe structural parts when the use of heating or pressurizing equipment would be impracticable.

PB 11167, Structural Changes of Commercial Titanium and Titanium-Base Alloys on Heat Treatment, Armour Research Foundation for Wright Air Development Center, 123pp. Price, $3.25.

PB 111881, The Effect of Grain Size on the Mechanical Properties of Titanium and Its Alloys, Batelle Memorial Institute for Wright ADC. 150pp. Price, $3.75.

PB 111898, Tensile Properties and Rheotropic Behavior of Titanium Alloys and Molybdenum, Case Institute of Technology for Wright ADC. 135pp. Price, $3.50.

PB 111776, Evaluation of Rho/Theta Transponder System, prepared for Air Navigation Development Board by CAA's Technical Development and Evaluation Center, Indianapolis. Price, $2.25.

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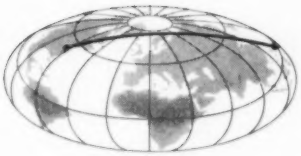

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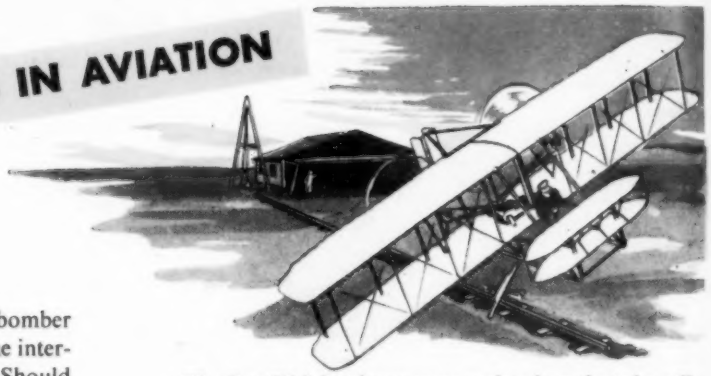

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